MAY, 1944

20,000 COPIES

TOOL & DIE JOURNAL

In a complete range of sizes from 1¼" to 6" diameter. Available from stock in right hand cut with right hand spiral, or left hand cut with left hand spiral.

SHELL END MILLS

Are Now *Standard* Putnam Tools

A new addition to the line of standard Putnam Hi-Speed cutting tools! Correctly designed and made of the finest high speed steels, these heavy duty shell end mills offer the same fast-cutting, long-lasting qualities typical of all Putnam tools. They are carried in stock—immediately available to increase the efficiency of your milling operations. Let us send you full information.

OUR CATALOG IS OUR STOCK LIST

NAVY

PUTNAM TOOL COMPANY

2985 CHARLEVOIX AVE. • DETROIT 7, MICH.

Check these Main Points

WHEN YOU'RE MACHINING STAINLESS STEEL

COME war or peace, stainless will always be a critical material *in the shop.* You'll want to keep rejects and spoilage low, as well as machining time and cost—and there are ways to do it.

Cutting speeds can't be as fast as with carbon steel or low alloys. Tools should be high speed steel or carbide-metal tipped, with a generous rake and a chip breaker, if possible. Keep them sharp, and don't allow the tool to ride on the work, to avoid work-hardening.

More important, check the design of the cutting tool itself, and check the possibility of using one of the special easy-machining grades of Allegheny Metal. Let us help you also to select the right cutting tool from the complete range of Allegheny Ludlum High Speed Steels and Carmet Carbide Tools.

Branch Offices in Principal Cities . . . Allegheny Metal also handled by all Joseph T. Ryerson & Son, Inc. Warehouses.

Have you a copy of the Allegheny Ludlum "Fabrication Blue Sheet"?

Contains a wealth of reliable, certified data, not only on the machining of Allegheny Metal, but on the best methods employed in other fabrication operations on stainless steel—forming, welding, finishing, etc. Write for your copy—you'll find it highly useful and complete.

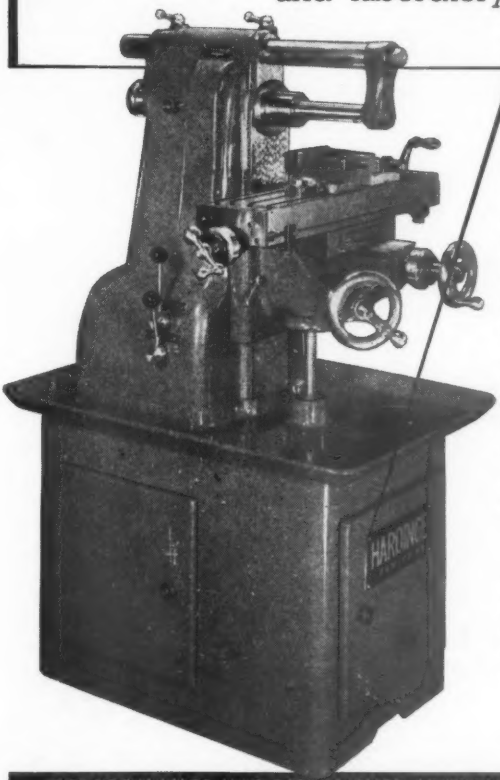
ADDRESS DEPT. TD24

Allegheny Ludlum
STEEL CORPORATION
General Offices
BRACKENRIDGE, PENNA.

4A W & D

HARDINGE

High Speed Precision MILLING MACHINE is designed for your tool room and laboratory



Precision tool room milling is profitable on this milling machine, designed to meet a definite need in the tool room and laboratory. The precision construction, along modern lines, combines ruggedness with extreme accuracy for ease of operation. Investment and time cost will indicate that larger milling machines are extremely expensive and awkward for many tool room and laboratory milling operations.

SPECIFICATIONS

1" collet capacity, 14" longitudinal, 13¼" vertical, 5½" transverse travel, eight speeds from 110 to 1850 R.P.M. TM model for plain milling, UM model for spiral milling.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Guard cap of shock-proof material provides unusual protection of Carboloy bushing-type gaging members. Can be removed for gaging "blind" holes.
A NEW
Trouble-Free Carboloy Gage
BY WOODWORTH
NO LOOSENING
NO DISTORTION
NO STRESSES
NO STRAINS

Exclusive Segmented Shank

(Patent applied for)

Woodworth's exclusive segmented shank compensates for differences in coefficient of expansion between cemented carbides and steel . . . thus assuring a trouble-free bond between these two metals.

The segments permit "breathing" . . . and allow for expansion or contraction due to temperature changes, with no distortion to the Carboloy gaging member.

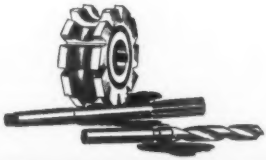
Write for Circular 44-C.

ACCURACY YOU W CAN TRUST

WOODWORTH

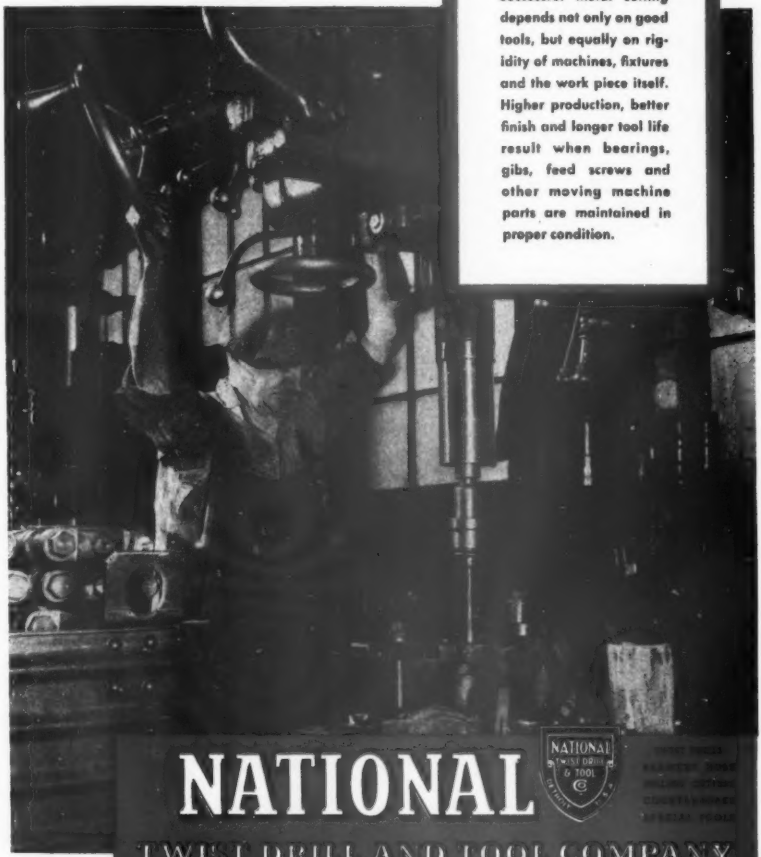
N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD · DETROIT 20, MICHIGAN

PRECISION GAUGES · GROUND THREAD TAPS · FORM TOOLS · PRECISION MACHINED PARTS · HEAT TREATING · PLATING



Rigidity IS IMPORTANT

Successful metal cutting depends not only on good tools, but equally on rigidity of machines, fixtures and the work piece itself. Higher production, better finish and longer tool life result when bearings, gibs, feed screws and other moving machine parts are maintained in proper condition.



NATIONAL

TWIST DRILL AND TOOL COMPANY

HOME OFFICE AND FACTORY—DETROIT, MICH.

THE ELLSTROMS THANK YOU...
Mr. GRANSTEDT

3117 Lincoln Avenue
San Diego, California
November 26, 1943

Mr. Elmer Ellstrom
c/o Dearborn Gage Company
22038 Beech Street
Dearborn, Michigan

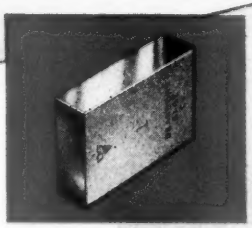
Dear Mr. Ellstrom:

It was with great interest that I read your company's ad in the November issue of the "Aviation" magazine about your father, Hjalmar Ellstrom, and the real background of the famous Swedish gage blocks.

Through my own father I heard a lot about your Dad's and Abrahams-son's primer work on the gage blocks long before C. E. Johansson stepped in and took hold of this great and worldwide important invention. It is not my intention to take any credit away from Johansson and his great work in connection with the famous gage blocks. But I am very glad to be able to, after many years of telling friends and co-workers in toolrooms about your Dad's work, to have something in print to back up my statement.

Yours truly,

Gustav C. Granstedt



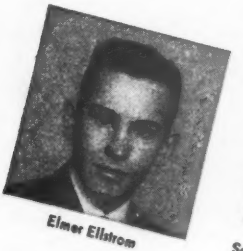
Picture of grandfather Hjalmar Ellstrom taken around 1900.

THIS unsolicited letter from Gustav C. Granstedt brings to light the part that Hjalmar Ellstrom played in pioneering the gage block. Because he never came to America to exploit his discovery his name was not known here until his son Elmer and grandsons Ralph, Elmer and Olof started the Dearborn Gage Co. in 1937.

Today, Ellstrom Chromium Plated Gage Blocks are recognized by industry throughout the world for their longer wearing qualities and fine accuracies.

Elmer Ellstrom

Ralph Ellstrom



Elmer Ellstrom

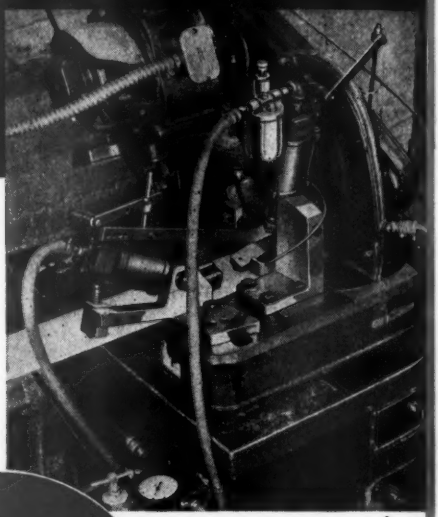
Olof Ellstrom
Sgt. in U. S. Army Air Corps

DEARBORN GAGE COMPANY. 22038 Beech Street • Dearborn, Michigan

Originators of Chromium Plated Gage Blocks

Bellows-Senacon AIR MOTORS make cut-off saw AUTOMATIC

BOOSTS PRODUCTION 370%
ELIMINATES SAW BREAKAGE



A Detroit airplane parts manufacturer was utting extruded aluminum strips 16' x 3" x ⅞" nto ½" pieces. Average net production was 70 pieces per hour. With women operators ½ to 5 hours had to constitute a shift, because f the fatigue factor. Saw breakage ran from 6 o 10 per shift. It was difficult to maintain olerances of .010".

The production superintendent thought of ellows — the unique air motor with precision ontrol. Three Bellows Air Motors were in-talled: one to feed the extruded strip, one to lamp the strip in cutting position, one to ad-ance the saw. The results were startling. 'roduction jumped 370%. A single saw would last six-een or more hours before esharpening. Tolerances /ere held to within .002". *ind all without an opera-or!* Once started, the Bellows Motors fed, clamped and cut he strip, automatically.

This is but one of hun-reds of installations where ellows-Senacon Air Motors, ir-operated Feeds, and Bel-ows Air Vises are doubling, ripling, even quadrupling roduction, lengthening tool ife, reducing worker atigue. Would you like a opy of our Case History 'hoto File, showing typical ellows-Senacon installa-ions? Write for File MB-3. No obligation.

The Bellows-Senacon Air Motor is equipped with an integral valve with operating control adjustable to any angle in any plane. May be synchronized to the machine cycle by linkage, cam action, or solenoids.

The Bellows Co.

ESTABLISHED 1911

861 EAST TALLMADGE AVENUE, AKRON, OHIO

QUICK, ECONOMICAL
LEVEL MACHINE INSTALLATIONS

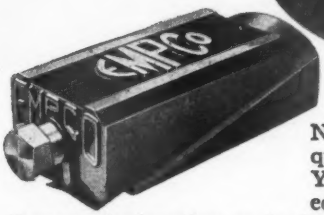
with

Empco JACKS

Adaptable to any floor, even or uneven.

EMPCO PRODUCTS

Look for this emblem; it is your guarantee of quality.



Now you can set up your machines more quickly and accurately than ever before. Yes, this EMPCO Jack is your answer to economical machine installations, because they require less time to do the job. EMPCO Jacks will also save time in periodic re-levelling because a simple turn of the "hex" screw head will raise or lower machine until perfectly level. It's the work of an instant. EMPCO Jacks are available in the following sizes:

Write for prices today or if you need them in a hurry, wire sizes you want and we'll ship immediately.

	Normal Height	Width	Normal Length
No. 1 (small)	2"	2 5/16"	4 1/4"
No. 2 (medium)	2 5/8"	3"	6 1/8"
No. 3 (large)	3 1/4"	4"	8 1/8"

IMMEDIATE DELIVERY

All shipments made from stock—orders shipped same day they're received.

EMPCO

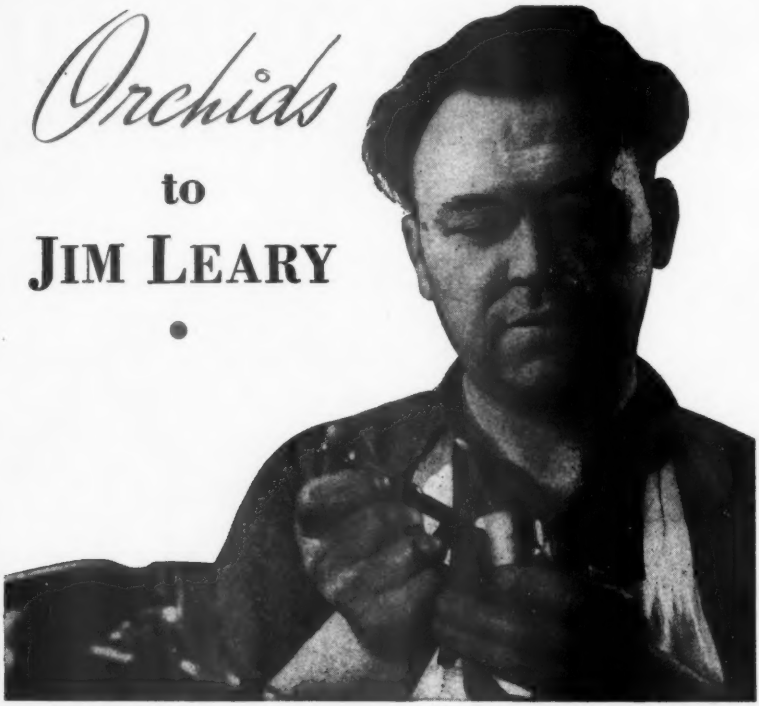
THE ENTERPRISE MACHINE PARTS CORPORATION

2731 JEROME AVE. DETROIT, MICH.

Orchids

to

JIM LEARY



We at Turner are justly proud of Jim Leary. First, because he has had a perfect attendance record since he started to work for us on September 20th, 1941. Second, because his skill in grinding has made it possible for us to produce precision gauges that help to speed up production on war material.

Yes, there are other "Jim Learys" in our plant who take pride in their work, that's why we have been able to maintain the highest standards in the manufacture of gauges, even during these days of labor shortages.

Look for this stamp of precision. It is your guarantee of a Turner Precision Made Gauge.

TURNER BROTHERS

TURNER GAUGE GRINDING COMPANY

2625 HILTON ROAD • • FERNDALE, MICHIGAN

WE **USE** THEM
AFTER WE **BUILD** THEM
SO THEY **MUST** BE GOOD!

LEMPCO

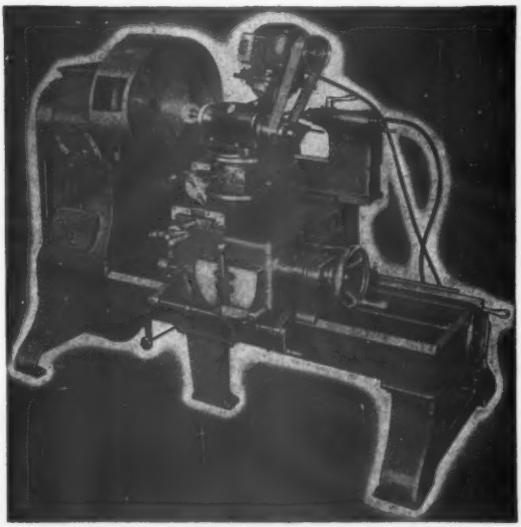
DESIGNERS • BUILDERS • USERS
OF
PRODUCTION-PROVED MACHINE TOOLS

HEAVY-DUTY UNIVERSAL

GRINDER

Turns and grinds, internal, external, face, and taper jobs! Three quick-change speeds for both cross-feed and table feed, automatic in both directions. Automatic trips and feeds insure accurate work even from new hands. Big 53" swing. Heavy duty grinding spindle; hollow work spindle with draw-bar for mounting work and fixtures to face plate. Interchangeable turning and grinding heads. Four quick selective work spindle speeds.

WRITE FOR SPECIFICATIONS



PROMPT DELIVERY!
CEILING PRICED!

LEMPCO
5713 DUNHAM ROAD
BEDFORD, OHIO, U★S★A

SPEED

SPIN THE HANDWHEEL and the ram speeds to the work by fast mechanical action instead of slow, laborious hydraulic pumping.

FLIP THE BALL ARM to close the valve instead of slowly turning a handwheel type control.

START PUMPING and immediately get tons of pressure on the work because the hydraulic cylinder was automatically filled with oil during oper. No. 1.

3 QUICK MOTIONS OPERATE KRW HYDRAULIC PRESSES!

SPEED is the basic design feature of KRW Hydraulic Arbor Presses—*they are faster than most power-operated presses.* In operation, you get *speed* in bringing the ram to the work . . . *speed* in developing hydraulic pressure . . . *speed* in raising the ram to remove the work. These KRW features have sold thousands of our hydraulic presses to industry where they are doing work formerly considered only possible on larger, heavier and more costly equipment. Ingenious adaptations of KRW presses have been built to handle many kinds, sizes and types of material. All, of course, incorporate the KRW principle of SPEED in operation. Write for our new bulletin describing KRW Hydraulic Presses in 25, 50, 60 and 75-ton capacities.

IMMEDIATE DELIVERY
on AA-4 Priority or better

K. R. WILSON
10 LOCK ST., BUFFALO 2, N. Y.

NUCUT TWO-FILE FILING HELPS STEP UP WARTIME PRODUCTION!

THIS ONE FILE DOES THE WORK OF TWO

WHAT do file users mean when they say a NUCUT File does the work of two files?

The answer can be found in a NUCUT'S teeth,—their structure, arrangement and the filing job they do. A NUCUT has both coarse teeth and fine teeth. Both work at the same stroke. The coarse teeth cut clean, deep, true. The fine teeth level the surface smooth. The result is NUCUT'S characteristic two-file filing, without skidding or scraping.

Whether you are cutting, shaping or finishing stainless steel, iron, aluminum, brass, copper, slate, wood, fiber or plastics, you will find a NUCUT gives you *more work, faster, easier,* with *less effort.* See your distributor today for the lengths, shapes and cuts you need.

HELLER BROTHERS COMPANY

America's Oldest File Manufacturers—Good Tools Since 1836

Newark, New Jersey — Newcomerstown, Ohio

Awarded to the Newcomerstown, Ohio, Plant

CAMERA SHOWS NUCUT'S "WAVY TEETH" DESIGN

From this reproduction of an unretouched microphotograph, you can see the patented (No. 2027039) wavy rows in which NUCUT teeth are positioned. It is this feature that enables a NUCUT to cut and finish—all at the same time.

HELLER NUCUT WAVY TEETH FILES

PAT. NO. 2027039

PRODUCTION *Cutting* WITH A WELLS NO. 8

CAPACITY
8" x 16" RECTANGULAR
8" DIAMETER, ROUND

To maintain metal cut-off PRODUCTION on demand output, and make your QUOTA PLUS . . . To hasten maintenance and repair work, and ELIMINATE COSTLY DELAYS on imperative production . . . Put a WELLS No. 8 to work . . . Built rigid and sturdy, it's portable, too . . . Move a WELLS SAW to the job and SAVE time, SAVE money.

WELLS Metal Cutting Band Saws are designed and produced for dependable service to meet the requirements of war time and peace time demands upon industry . . . Every second counts with a WELLS. In its Continuous Cutting Action every tooth in the blade band does its share of the work. Write for descriptive bulletin on WELLS SAWS.

Wells SAWS

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1940 ASH STREET, THREE RIVERS, MICH.

The Machine of Tomorrow—
TODAY!

Sav-way SPITFIRE
ELECTRO-HYDRAULIC INTERNAL GRINDER

Modern Functional Design Throughout

*

Neoprene Insulated

*

Famous Gold Seal Spindle

*

Electrically-Operated Diamond Wheel Dresser

Ready ahead of time—the Sav-Way MH-1 combination hand and electro-hydraulic internal grinder. 5/32" minimum table stroke! Gatling gun table speed through the use of aircraft-type micro-limit switches and solenoid-operated valves. Electrical, automatic, adjustable cross feed. Dozens of outstanding features! It's a postwar machine—ready now to help speed today's war production! Its low cost will surprise you.

Sav-way INDUSTRIES
Machine Tool Division
BOX 117 HARPER STATION, DETROIT 13, MICH.

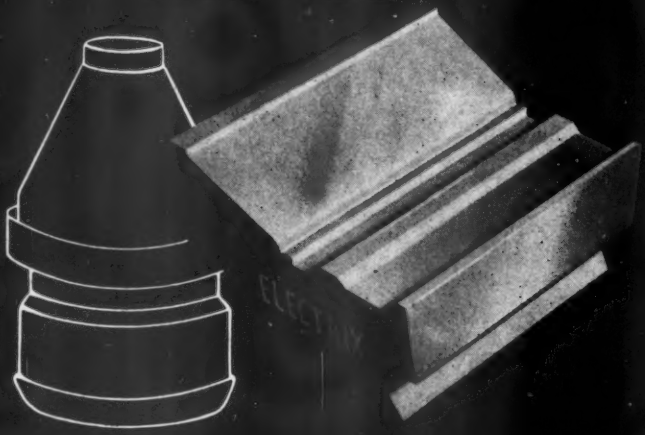
Send for Actual Photographs, Specifications, and Prices

BUILDERS OF HAND AND HYDRAULIC INTERNAL GRINDERS • PRODUCERS OF GOLD SEAL SPINDLES
PLUG GAGES • MICROMETER CHECKERS • PRECISION AIRCRAFT AUTOMOTIVE AND ORDNANCE PARTS

use

ELECTRIX

Form Tools



for . . . BETTER MACHINING
GREATER ACCURACY
FEWER REJECTS

Write us about YOUR Form Tool requirements . . . TODAY!

GO — PRECISION AUTHENTICATORS — NO-GO

Peacetime engineers of soft-rubber connectors for electrically-operated equipment, sold exclusively through U. S. RUBBER CO.

ELECTRIX Corporation

156 MIDDLE STREET • PAWTUCKET, R. I.

KEEPING TUBE ROLLS *True to Form*

DEMONSTRATES THE ADAPTABILITY OF A DUMORE PRECISION GRINDER

Welded steel tubing produced by a certain midwest mill is used for various purposes necessitating precise and uniform outside diameter. The important job of maintaining the forming rolls in correct shape and accurate dimension is performed by a Dumore Precision Grinder. The axis of the quill is placed at right angles to the axis of the roll, by mounting the grinder on a specially devised bracket at the rear of the lathe.

The increasing use of the Dumore Precision Grinder on production operations is a natural result of its abundantly demonstrated adaptability as well as the high precision of its operation. Many unusual applications are illustrated in the Catalog 42. Send for a copy. The Dumore Company, Tool Division, Department TE42, Racine, Wisconsin.

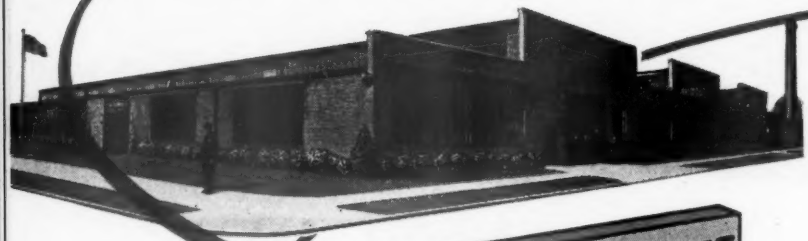
Thread Grinding is a special operation efficiently performed by the Dumore. . . . This bulletin explains how. Send for copy today.

DUMORE

PRECISION AND OFF-HAND GRINDERS

SOLD BY AUTHORIZED INDUSTRIAL DISTRIBUTORS IN ALL PRINCIPAL CITIES

INCREASINGLY



McKINNEY
CLEVELAND

McKINNEY craftsmen toolmakers (above)

A jig that demanded exceptionally accurate workmanship (left)

SYNONYMOUS

DEPENDABLE PRODUCTION TOOLING

Just as the name IVORY suggests soap and WRIGLEY means "gum" — McKINNEY — CLEVELAND — is coming more and more—instantly and definitely to mean "tooling equipment".

Largely responsible for this growing recognition is a consistent record for delivering "tooling equipment" that operates smoothly within specified tolerances and delivers a large output at low cost consistent with quality.

In most instances McKINNEY handles the engineering and tool building—in other cases the tools are produced to customers' designs and more and more frequently McKINNEY engineers are being called into consultation at the outset of a manufacturing program.

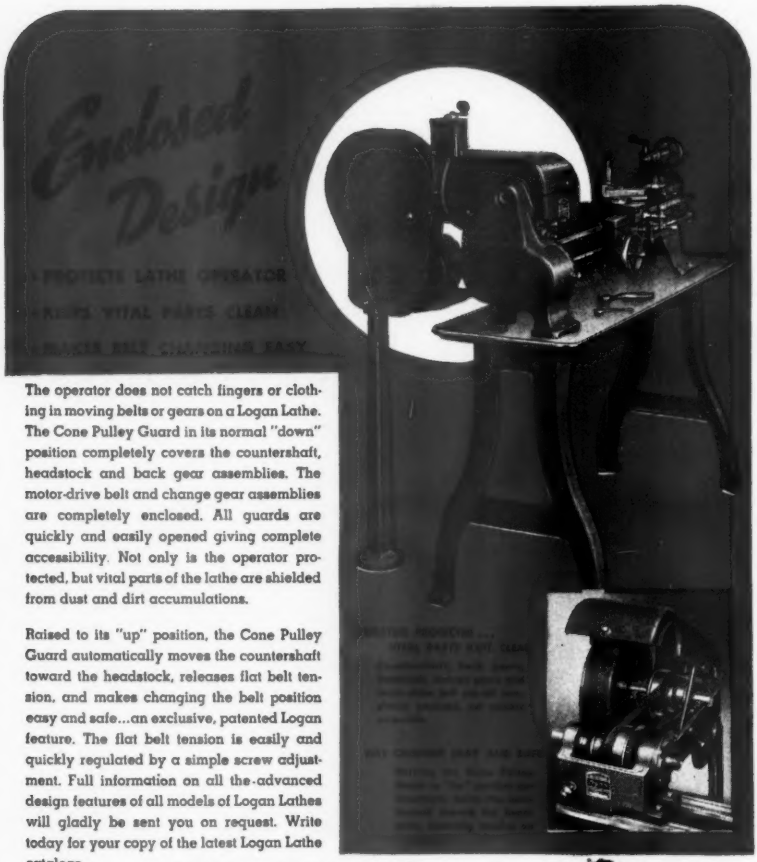
When you think of "tooling", recall McKINNEY—CLEVELAND as an organization of demonstrated ability to whom you can turn with confidence. The phone at your right hand will bring a McKINNEY representative quickly. The number, IVanhoe 2300. Sketches or blueprints mailed in will receive prompt and capable attention.

McKINNEY TOOL & MFG. CO.
CLEVELAND

DESIGNERS and BUILDERS of PRECISION TOOLING
Since 1920

1673 Arabella Road

Tools-Dies-Jigs-Fixtures-Special Machinery

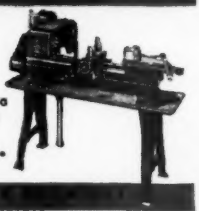


The operator does not catch fingers or clothing in moving belts or gears on a Logan Lathe. The Cone Pulley Guard in its normal "down" position completely covers the countershaft, headstock and back gear assemblies. The motor-drive belt and change gear assemblies are completely enclosed. All guards are quickly and easily opened giving complete accessibility. Not only is the operator protected, but vital parts of the lathe are shielded from dust and dirt accumulations.

Raised to its "up" position, the Cone Pulley Guard automatically moves the countershaft toward the headstock, releases flat belt tension, and makes changing the belt position easy and safe...an exclusive, patented Logan feature. The flat belt tension is easily and quickly regulated by a simple screw adjustment. Full information on all the advanced design features of all models of Logan Lathes will gladly be sent you on request. Write today for your copy of the latest Logan Lathe catalogs.

BRIEF SPECIFICATIONS

Swing over bed, 10½" . . . bed length, 43½" . . . spindle hole, 7/32" . . . capacity, ⅝" with push type collet . . . 8-position automatic indexing turret . . . stroke of turret, 4¼" . . . 12 spindle speeds from 30 to 1450 r.p.m. . . . all moving parts protected by ball bearings or self lubricating bronze bearings.



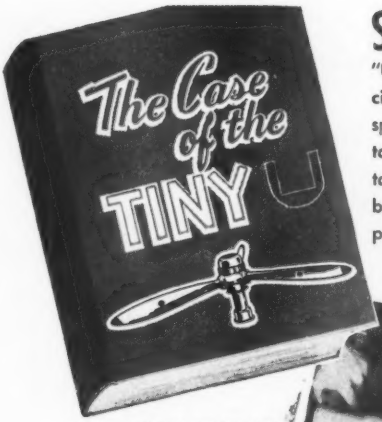
No. 850 MANUFACTURING TURRET LATHE

Logan

LOGAN ENGINEERING CO.

CHICAGO 30, ILLINOIS

One of a series describing the finer features of Logan Lathes . . .



SHOWN at the left in actual size is the tiny "U" that so typifies broaching's solution of precision production problems. This tiny "U" is the spring pack retainer used in propeller blades to relieve torque stress. With capacity of 10 ton pull Lapointe designed a machine and 12 broaches to produce literally millions of these parts to fine precision tolerances.

Fed from the left, bar stock takes 3 initial rough cuts then 3 finish cuts to form the inside of the "U".

Then 3 more cuts form the round part of the "U" and 3 more cuts cut off 3 finished pieces.

Finished Parts roll down the delivery chute while operator holds bar stock showing the 12 successive cuts.

Only by Broaching was this phenomenal Precision Production record possible

The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

MAKERS OF BROACHES AND BROACHING MACHINES

FIRST BITE IN ANY FIGHT

SIEWEK-BUILT "PROGRESSIVE"

SHEAR-CUT END MILLS

End mills must bite metal, before metal can fight.

Busy converting metals into American armament, Progressive Shear-Cut End Mills are cutting cleaner, faster and longer on the toughest jobs! Precision made of the finest materials, these end mills feed accurately, minimize chatter, give uniform cutting action and adequate chip clearance . . . permit working to extremely close limits.

Now manufactured by Siewek Tool Division of Domestic Industries, Inc. . . . Progressive "Shear-Cut" End Mills are the same high character product—with the *extra* resources and service of Domestic Industries, Inc.

When you need end mills, specify "Shear-Cut." They'll serve you long and well in starting your armament on the road to victory . . . as they have for so many others.

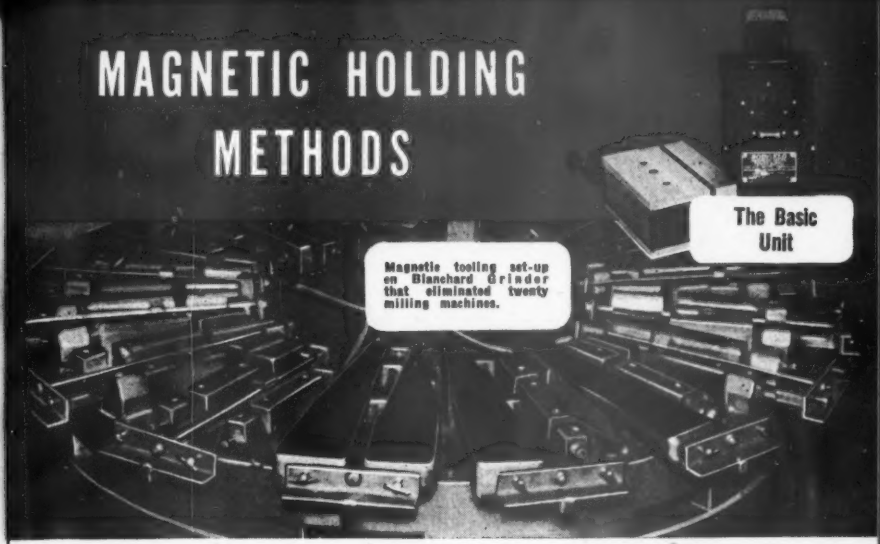
SIEWEK TOOL DIVISION
OF DOMESTIC INDUSTRIES, INC.
DETROIT (Ferndale Station) MICHIGAN

DOMESTIC DI INDUSTRIES

Distributors in Principal Cities

AFFILIATED WITH SIEWEK ENGINEERING DIVISION—CHICAGO • DETROIT • HARTFORD, CONN. AND SPRINGFIELD, MASS.—DESIGNERS AND BUILDERS OF TOOLS, DIES, JIGS, FIXTURES AND SPECIAL MACHINES

MAGNETIC HOLDING METHODS



New Holding Applications

Magnetic holding fixtures may be made and adapted so that work may be held magnetically, eliminating the necessity of clamping.

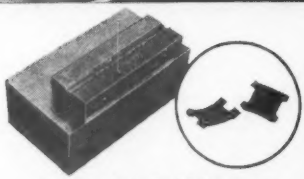
Even work that keeps the tool engineer sitting up nights to design a suitable fixture, may be easily and quickly handled with a magnetic holding adapter.

The tooling shown above required several of our basic units which were readily applied to the Blanchard Grinder. The method shown broke a bottleneck and also reduced the cost of machining the parts to less than one-fourth of former cost.

The use of magnetic adapters with our basic units offers wide possibilities for quick and inexpensive solutions for many of your holding problems. Difficult set-ups of either large or small work may be handled.

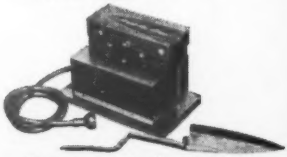
Are you overlooking the possibilities of magnetic holding fixtures?

Send for "Magnetic Chucking Revolutionized"



Magnetic adapter for holding concave brake shoes for form grinding. Work shown one-half actual size.

Custom built circular Magnetic Chuck to hold special work for lathes and grinders.



Sheep shear blade die adapted for magnetic holding; operation, hollow grinding blade.

MAGNETIC HOLDING DEVICES, INC.

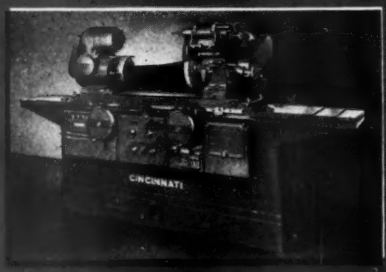
2034
EAST 22ND ST.
CLEVELAND 15,
OHIO

Give Your *A Break*

An Internal Job. Here the Internal Grinding Attachment has been pulled down into position for grinding the bore of a short shaft so as to assure a close fit. The attachment is standard equipment always in place and may be set up at a moment's notice.

A Face grinding job on the CINCINNATI Hydraulic Universal

An External job. Grinding the taper—3½" per foot—on the shank end of an experimental driving gear. Notice, on Internal Grinding Attachment on the frame of the wheelhead. The attachment is up and out of the way but ready for instant use.



THE CINCINNATI MILLING MACHINE CO.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . SURFACE BROACHING MACHINES . . CUTTER SHARPENING

New Product in the Toolroom

The first few samples of your new product for tomorrow's market must be made on machine tools, in the *tool room*. There, they pass through their most critical period. There, the product can be started on its way to success or failure. With versatile and up-to-date tool room machines for manufacturing the parts, the chances are that the performance of the assembled unit will equal blue-print specifications.

CINCINNATI Hydraulic Universal Grinding Machines have all the qualifications for tool-room work of this type. They will size accurately, within .0001", and produce exceptionally smooth finishes with no extra effort. Changes from external to internal or face grinding may be accomplished in a few minutes. The table continually reverses within .004", enabling the operator to confidently grind close to shoulders.

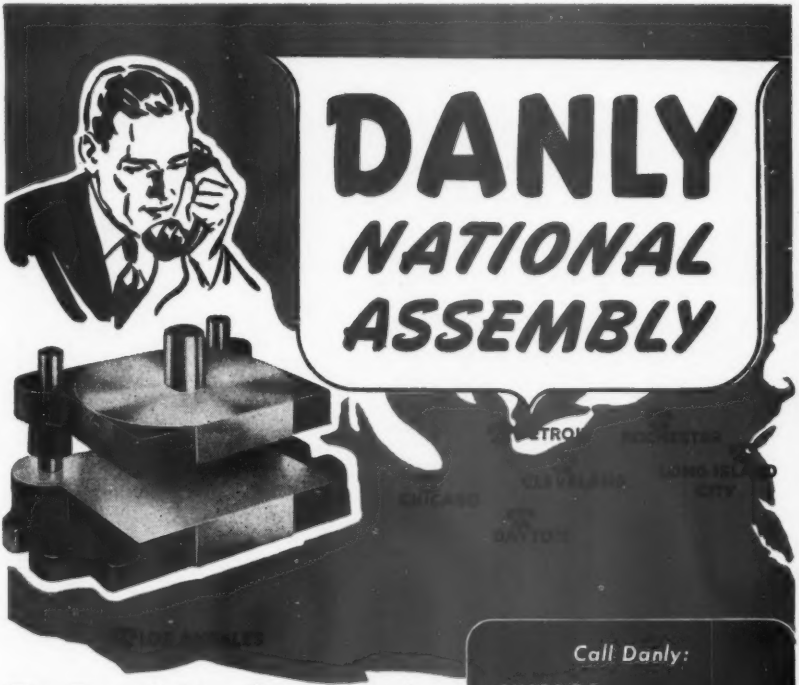
These few statements give you an idea of the fine work which can be produced on CINCINNATI Hydraulic Universal. Complete information may be obtained by writing for catalog G-486-1 (12" size) or G-474-1 (14", 16" and 18" sizes).

CINCINNATI

Left: CINCINNATI 12"
Hydraulic Universal Grinding Machine

MACHINES . . CENTERTYPE GRINDING MACHINES . . CENTERLESS GRINDING MACHINES . . CENTERLESS LAPPING MACHINES

6 MILLION PERFECT PARTS
PRODUCED BY DIES MADE
OF Graph-Mo Steel!
During the past five years, a set of dies made from Graph-Mo Steel produced 6,000,000 clutch housings for automobile window regulators.
Despite this impressive record, these dies are continuing to provide trouble-free performance and to produce perfect, scratch-free parts that are accurate to .002".
This kind of proven performance is responsible for the steadily increasing popularity of Graph-Mo and the other Graphitic Steels, Graph-Tung, Graph-Sil, Graph-Al and Graph-M.N.S.
Include these five steels in your Post War plans. They will increase production and cut costs because they wear longer, they machine at least 25% faster than competing steels and they have less tendency to score work.
One of our engineers will be glad to recommend the proper Graphitic Steel for any specific application you have in mind. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.
TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS



To Precision Standards

Precision finish of every part in Danly standard die sets makes possible Danly National Assembly. The resultant perfect fit saves you time and money through faster setups and longer, trouble-free operation.

Every Danly Die Set is individually assembled to your specification, through the Danly Plan of National Assembly to Precision Standards.

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue • Chicago 50, Illinois

Call Danly:

CHICAGO
2100 South 52nd Ave. . . Lawndale 7440

DETROIT
1549 Temple Avenue . . . . . Cherry 6666

CLEVELAND
1550 East 33rd Street . . . . Express 0300

DAYTON
990 East Monument . . . . . Fulton 6651

ROCHESTER
16 Commercial Street . . . . . Main 2554

LONG ISLAND CITY
47-28 37th Street . . . . . Ironsides 6-8080

DUCOMMUN METALS & SUPPLY CO.
Los Angeles . . . . . Kimball 0181
4890 South Alameda Street

DIE MAKERS SUPPLIES • *Welded Steel Fabrication*

Grobet
ROTARY FILES

Grobet Hand Cut, Milled Cut and Ground Cut ROTARY FILES can now be purchased in units of 50 to 100 in a special shipping container, without extra cost. This strongly made box is ideal for use in place of a rack. Files do not touch and are kept clean and in perfect condition. Also used to return files for resharpening.

Send for Catalog B, most complete, illustrating and describing GROBET ROTARY FILES, DIE-SINKER'S BURS, TUBE BURRING CUTTERS, CHATTERLESS COUNTERSINKS, etc.

GROBET FILE CO. of AMERICA

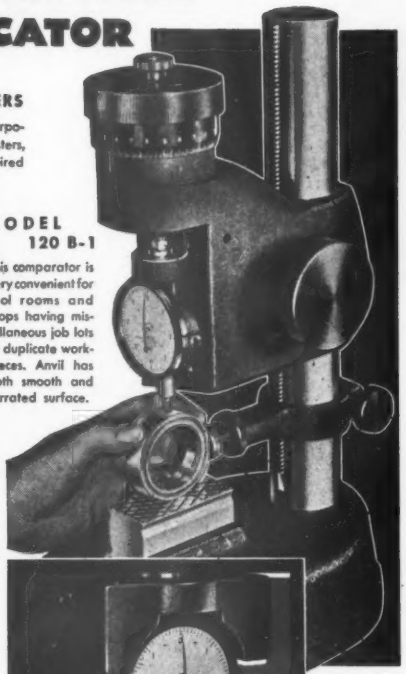
421 Canal Street 1912 **New York, 13 N. Y.**

IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES

It's New - a COMPARATOR *with* MICROMETER HEAD *and* DIAL INDICATOR

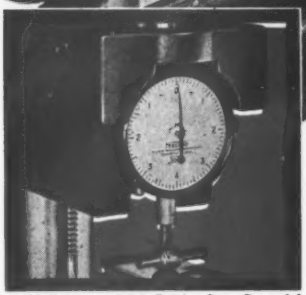
YOU SET IT DIRECTLY WITHOUT MASTERS

The combination Micrometer and Dial Indicator Head incorporates its own Master. A complete set of Gage blocks, or masters, are not necessary. You simply set the micrometer to the required dimension, lock it, and then compare workpieces, etc.



MODEL 120 B-1

This comparator is very convenient for tool rooms and shops having miscellaneous job lots of duplicate workpieces. Anvil has both smooth and serrated surface.



THREE-WIRE THREAD MEASURING

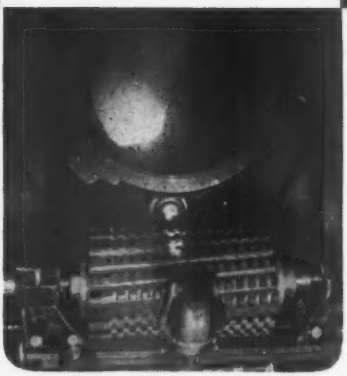
is easy on this new comparator because the Micrometer Head enables you to read the actual dimension of the Pitch Diameter. The Dial Indicator then compares the diameters of other similar screw threads. The weight over the Indicator is for coarse threads.

FEDERAL PRODUCTS CORPORATION · 1144 Eddy St., Providence, R. I.

FEDERAL

PRECISION MEASURING INSTRUMENTS

The Grandfather of Ground-Thread Milling Cutters



Shadowgraph checks accuracy of PM Multiple Thread Mill to 1/10 of one thousandth of an inch.

BUY AN EXTRA

WAR BOND TODAY

We make them all sizes—from giants like this, 10¾" dia. x 12¾" long—to little ones down to half inch diameter.

And whatever their size or pitch or number of cutting edges, they all belong to the same family—the PM family.

With a lot of experience on multiple thread mills, we've got a pretty good idea of what these important tools are expected to do.

So we make them all to the same standards of precision and accuracy and hardness we require in our own tools. And then check every one—on the most modern type of inspection equipment—just to make extra sure of what we already are sure of.

If you use multiple thread mills let us have your specifications—to quote you prices and delivery dates. You can put a lot of confidence in any cutting tool that carries the PM Diamond emblem.

PM CO

The PIPE MACHINERY COMPANY Cleveland, O.

U.S. TOOL MFG. CO.

. . no tools can be better than the standards set for their inspection

U. S. TOOL & MFG. CO.

6906 Kingsley, Dearborn Mich.

Severance new tool craftsmen regrind worn tools with the same precision and **skill they use in manufacturing new tools. They give each flute the pitch and depth** **required to eliminate chatter. They carefully grind each tooth so your renewed tools take deep sharp bites like a new Severance Cutter.** **Each tool is given the Severite heat treat process that increases tooth hardness** **and lengthens cutting life 3 to 5 times. It will pay you to send your dull cutters (hand ground, mill or** **chisel cut) to Severance for a factory regrind job.**

Severance

MIDGET MILLING CUTTERS • PRECISION REGRINDING • Severance Tool Industries Inc., Saginaw, Mich. • Plants in Long Island City 1, N. Y.; Detroit 2, Mich.; Fort Wayne, Ind.; Chicago 6; and Los Angeles 21, California. In Canada: 60 Front Street West, Toronto, Ontario.

Big or little jobs for "mechanical muscle"... are handled with TOP speed and efficiency by T-J Air and Hydraulic Cylinders!

They're ruggedly built to "take it"... with bodies honed to accurate concentricity and straightness... all mounting surfaces strictly inspected for squareness and smoothness... one piece piston construction for greater dependability.

T-J AIR CYLINDERS exert power movement from 100 lbs. to 12,000 lbs. (direct). T-J HYDRAULIC CYLINDERS exert power movement from 1000 lbs. to 50,000 lbs. (direct). Available in sizes, styles and strokes to meet your requirements. Precision-manufactured and expertly engineered with T-J's quarter century experience. Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY T-J

TOMKINS-JOHNSON

RIVETORS ... AIR AND HYDRAULIC CYLINDERS ... CUTTERS ... CLINCHERS

SHEFFIELD DIAL INDICATOR *SNAP GAGE*

FOR INSPECTION AND CLASSIFICATION

1 Gage may be used with dial either at the bottom or the top, whichever is more convenient.

2 Dial is adjustable radially and can be swung through 360° to facilitate reading.

3 Scale has a range of .005"—each graduation .0001".

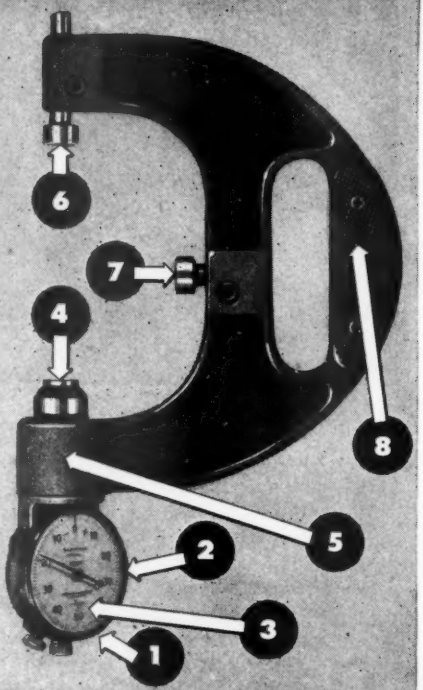
4 Movable anvil is spring urged for constant gaging pressure, but spring has no effect on indicator. Special spring pressures available.

5 Movable anvil bearing is long enough to preserve alignment with the fixed anvil.

6 Fixed anvil is adjustable to a maximum of one inch.

7 Adjustable backstop has a cylindrical face for accurate line contact.

8 Comfortable handle with plastic grip to insulate gage from heat of inspector's hand.



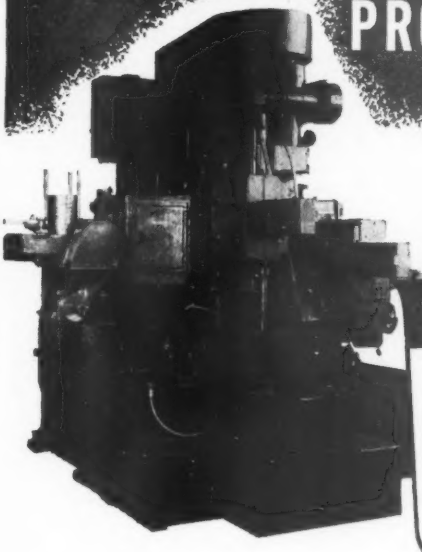
SHEFFIELD MASTER CRAFTSMEN

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U.S.A.

MACHINE TOOLS — GAGES — MEASURING INSTRUMENTS — CONTRACT SERVICES

BESLY GRINDERS Step up PRODUCTION!



THE PROBLEM ••

To speed the accurate grinding of parallel surfaces on small parts such as thrust washers, oil seals, sides of bearing races, piston rings, etc.

THE SOLUTION ••

Besly No. 926 Grinder

The 926 Besly Vertical Double Spindle Grinder is used as the finish grinder for parts that have been previously rough ground on standard double spindle grinders.

Send for this Booklet on Besly Titan Steelbac Discs — uniform, easy to mount, they speed output.

Charles H. Besly and Company was awarded the Army-Navy "E" on December 1, 1943. More than ⅓ of the holders of the coveted "E" are Besly customers.

RESULTS •• 6 ⅛" x 3/32" aircraft engine piston rings were finished to within .0002" for size and parallelism. Light test for flatness, perfect—at rate of 140 passes per minute. Six to eight Micro Inch Finish produced with help of Grain No. 120 Besly Titan Abrasive Members.

BESLY BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY, 118 N. Clinton St., Chicago 6, Ill. Factory: Beloit, Wis.

SHEFFIELD DIAL INDICATOR *SNAP GAGE*

FOR INSPECTION AND CLASSIFICATION

1 Gage may be used with dial either at the bottom or the top, whichever is more convenient.

2 Dial is adjustable radially and can be swung through 360° to facilitate reading.

3 Scale has a range of .005"—each graduation .0001".

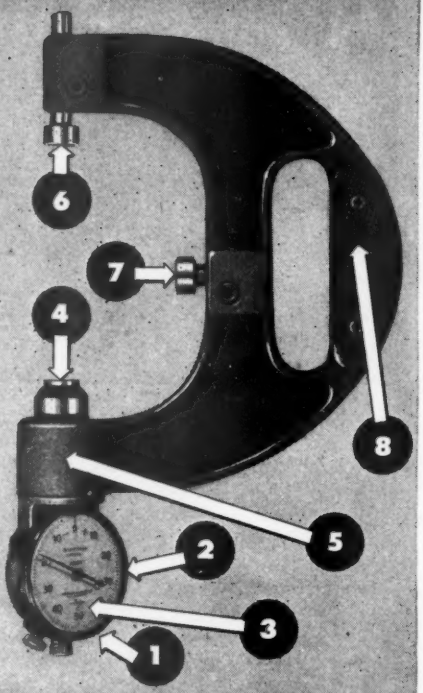
4 Movable anvil is spring urged for constant gaging pressure, but spring has no effect on indicator. Special spring pressures available.

5 Movable anvil bearing is long enough to preserve alignment with the fixed anvil.

6 Fixed anvil is adjustable to a maximum of one inch.

7 Adjustable backstop has a cylindrical face for accurate line contact.

8 Comfortable handle with plastic grip to insulate gage from heat of inspector's hand.



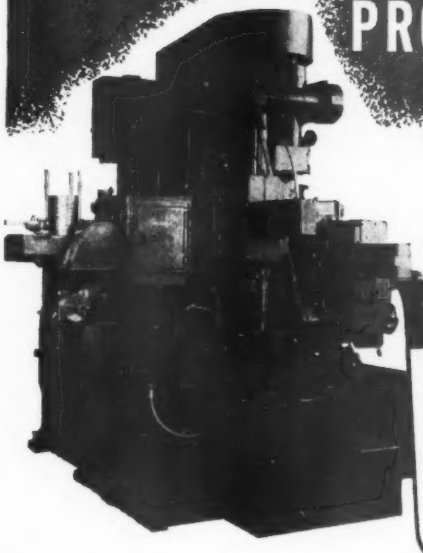
SHEFFIELD MASTER CRAFTSMEN

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U.S.A.

MACHINE TOOLS — GAGES — MEASURING INSTRUMENTS — CONTRACT SERVICES

BESLY GRINDERS Step Up PRODUCTION!



THE PROBLEM ••

To speed the accurate grinding of parallel surfaces on small parts such as thrust washers, oil seals, sides of bearing races, piston rings, etc.

THE SOLUTION ••

Besly No. 926 Grinder

The 926 Besly Vertical Double Spindle Grinder is used as the finish grinder for parts that have been previously rough ground on standard double spindle grinders.

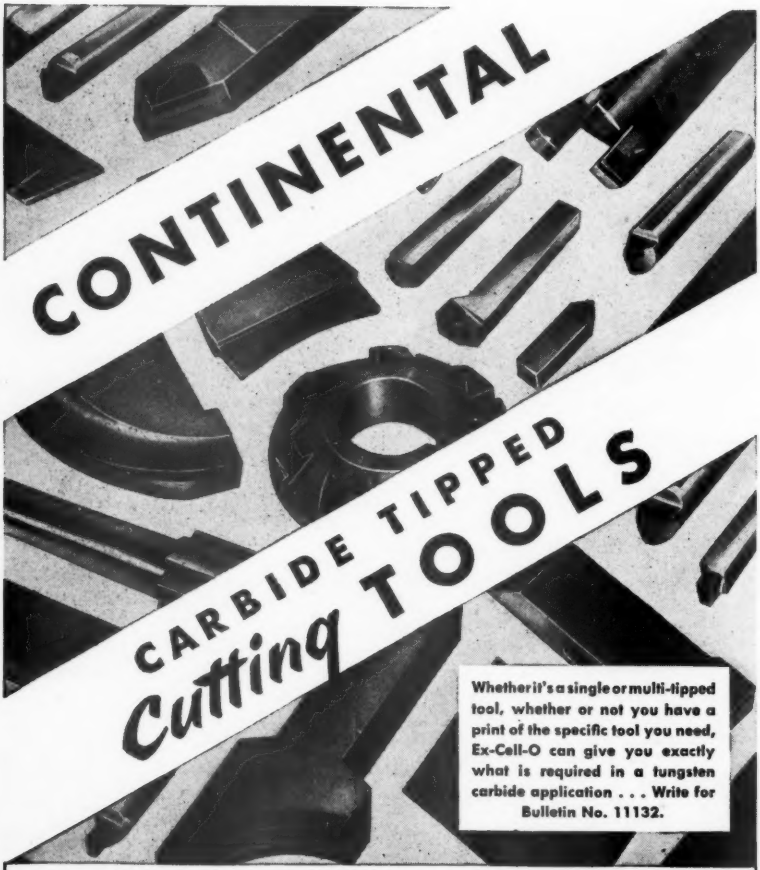
Send for this Booklet on Besly Titan Steelbac Discs — uniform, easy to mount, they speed output.

Charles H. Besly and Company was awarded the Army-Navy "E" on December 1, 1943. More than ½ of the holders of the coveted "E" are Besly customers.

RESULTS •• 6 ⅛" x 3/32" aircraft engine piston rings were finished to within .0002" for size and parallelism. Light test for flatness, perfect — at rate of 140 passes per minute. Six to eight Micro Inch Finish produced with help of Grain No. 120 Besly Titan Abrasive Members.

BESLY BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY, 118 N. Clinton St., Chicago 6, Ill. Factory: Beloit, Wis.

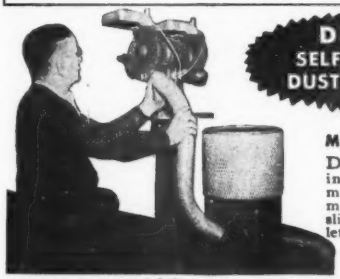

CONTINENTAL
CARBIDE TIPPED
Cutting TOOLS
Whether it's a single or multi-tipped tool, whether or not you have a print of the specific tool you need, Ex-Cell-O can give you exactly what is required in a tungsten carbide application . . . Write for Bulletin No. 11132.

EX-CELL-O CORPORATION, DETROIT 6

XLO
EX-CELL-O for PRECISION

Precision MACHINE TOOLS • CUTTING TOOLS • AIRCRAFT AND MISCELLANEOUS PARTS

Quick way to STOP DUST!



DUSTKOP
SELF-CONTAINED
DUST COLLECTORS

MODEL 600
DUSTKOPS are installed in a few minutes. Flexible metal hose makes slip fit with dust outlets on grinder.

MODEL 950
This unit, with dust hoods, "ready to go," fits any double-end pedestal grinder not already equipped with wheel guards and dust outlets.

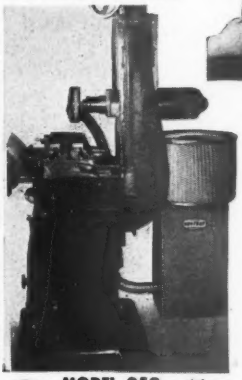
DUST STOPPED ON ALL ABRASIVE OPERATIONS AT LOWEST COST

MODEL 600
With flat, spun glass filter for compact bench installation. Pulls all dust from two grinder wheels.

For quick, economical, effective, dust control *at the source*, install DUSTKOPS. Easy to attach to surface grinders, disc grinders, cutter and tool grinders, flexible shaft grinders—or to buffers, sanders and abrasive cut-offs—whether single or multiple units. Large or small models available.

DUSTKOPS are compact and portable. Entirely self contained, with motor, fan, cyclone separator (in all but smallest models) and spun glass filter. Flexible metal hose permits quick installation.

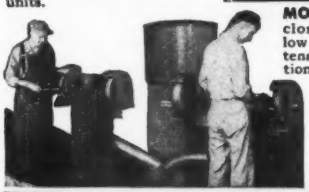
DUSTKOPS clean the dust-laden air without wasting heat. Efficient cyclone separator provides low maintenance. Many other features make DUSTKOPS ideal for your shop or laboratory. Immediate shipment of "standard" voltage units.



MODEL 950—has cyclone separator, plus spun glass filter. For medium duty work of all kinds.

MODEL 950—with cyclone separator means low first cost, low maintenance, even on production surface grinder.

MODEL 1250—gets all dust and smoke from this heavy duty abrasive cut-off, at extremely low cost.



(Left)
MODEL 1250—one unit handles dust from four wheels.

Write NOW for Bulletins

AGET-DETROIT COMPANY
617 First National Building • Ann Arbor, Michigan
Detroit Office: Tol. CAdillac 3090

THERE is everything to be said about having exactly the right wheel on any kind of a cylindrical grinding job—and on every grinding job! This is an all important factor in getting higher production and greater precision.

Proper wheel selection also reduces grinding time, lowers wheel and grinding costs, makes certain of getting a desired finish.

Carborundum abrasive engineering service certainly can be of decided help in getting these results—in your getting the best and the most out of your grinding wheels. This service we feel can be of great value to you. We suggest you take advantage of it.

Incidentally, we have quite a library of helpful booklets on Tool Room Grinding, Roll Grinding, The Grinding of Cemented Carbides, Common Grinding Faults and Their Correction, etc. Copies sent on request. The Carborundum Company, Niagara Falls, New York.

Grinding Wheels by CARBORUNDUM

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade mark of and indicates manufacture by The Carborundum Company)

MOTØRIZE *with* LIMA DRIVES

For unit motorization of Machine Tools, you can select no better drive equipment than that made by LIMA.

These units are built in sizes from 1 to 25 hp, to meet the users every requirment of selective speed drive equipment.

Our satisfied customers are proof that LIMA Gearshift Drives do their jobs *Faster* and with *Greater Precision and Safety*

Wire or write today for address of Lima Engineering Service nearest you. Let our Engineers show you how LIMA can serve in *your* plant.

Large enough to successfully serve you, yet small enough to give personal attention to your needs.

THE LIMA ELECTRIC MOTOR CO.

880 Findlay Road

LIMA, OHIO

REPRESENTATION IN MOST PRINCIPAL CITIES

LIMA GEARSHIFT DRIVES - LIMA ELECTRIC MOTORS
LIMA MAGNETIC POLISHING LATHES - LIMA PEDESTAL GRINDERS

IN THE

Aircraft Industries

SOUTH BEND LATHES have long been popular for precision manufacturing operations and fine tool work in the aircraft industry. Today, in the greatest plane production schedule in history, these modern lathes are more than keeping their traditions for dependable precision and exacting tolerances. Providing lathes to most of the aircraft industry is one of our many important war assignments.

Buy War Bonds . . .
Save for Lathes

SOUTH BEND LATHE WORKS
SOUTH BEND 22, INDIANA
Lathe Builders For 37 Years

CONTOURING

... another Function of the Shaper

WHILE the Shaper is indispensable in the toolroom, it is also very much at home in manufacturing shops.

In your shop there may be jobs, involving the principle of contouring, that are best performed on a Shaper.

Cincinnati Shapers are accurate . . . responsive . . . profitable.

Write for Catalog N-2.

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS BRAKES SHEARS

The CHICAGO SCREW Co. has ADEQUATE FACILITIES

MANPOWER

MATERIAL

MACHINES

Manpower, material and machines are contributing factors to the ability of The Chicago Screw Company to produce quality products. As a result of these adequate facilities, CHICAGO "SAFETY PLUS" Socket Head Cap Screws, Socket Set Screws, Pipe Plugs, Stripper Bolts and Square Head Dog Point Set Screws are produced in great volume. Large and complete stocks are maintained at our factory, and by our distributors.

ARMY (E) NAVY

These Fine Products are sold only thru Authorized Distributors

THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 So. Homan Avenue — Chicago, Ill.

BIG SNAP-LITTLE SNAP

Big or little—there is a Vard John-Sons Roll Thread Snap Gage to meet your gaging needs.

These snap gages have concentric rolls of alloy tool steel, precision ground and lapped, and will check either right or left hand threads. The VE and VF models are offered in sizes from ¼ in. to 12 inches (big snap) in National, Acme, Whitworth and Metric Thread forms. Type VC (little snap) is used for gaging threads size No. 0 to No. 12.

Vard Snap Gage frames are cast of meehanite, a special high strength alloy with a low heat coefficient.

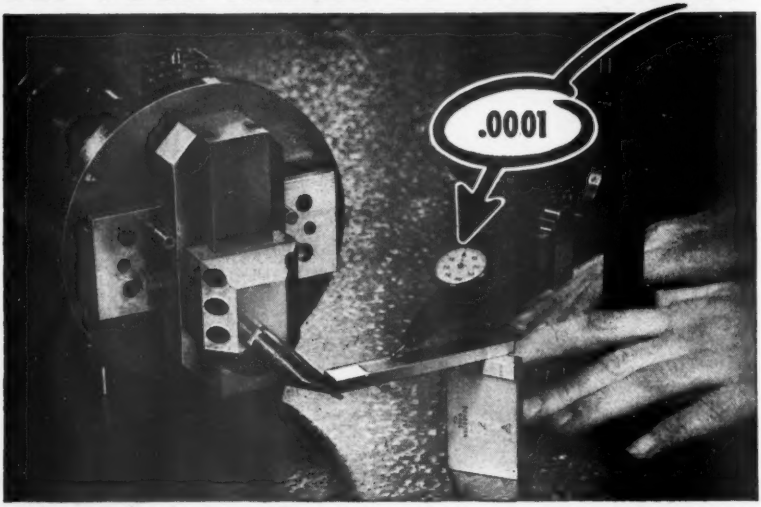
All Vard rolls are set on eccentric pins which are adjustable to desired tolerance or can be reset to compensate for wear.

Write for Vard Catalog on gages!

VARD INC.

PASADENA 8, CALIFORNIA

SET YOUR RADIUS TO THE *tenth!*



Quick and *Accurate* set-ups can be made with this Perfex Angle to Tangent Radius Dresser

Now it is possible for you to set your radius to the tenth (.0001) in a few minutes. Why waste valuable man-hours in setting up the ordinary type of dresser when a Perfex Angle Tangent to Radius Dresser can save you both time and money—in fact, a Perfex Dresser will actually pay for itself by the savings it will effect in your plant.

Read these Perfex features. They will convince you of its superiority.

1. Radius can be set accurately to within .0001. 2. It is possible to return the diamond to center after dressing an angle within .00005. 3. It is possible to dress a smaller than .050 radius to a full half circle without additional attachments. 4. The Perfex Dresser dresses in horizontal position exactly in the plane in which the work will be ground. 5. The vernier is very legible, and can be easily read from normal position. 6. All moving parts made from hardest steel ground and lapped to a perfect fit. 7. All surfaces protected from rust.

With this new low price of $495 (less diamonds) it will more than pay you to order one of these Perfex Dressers today!

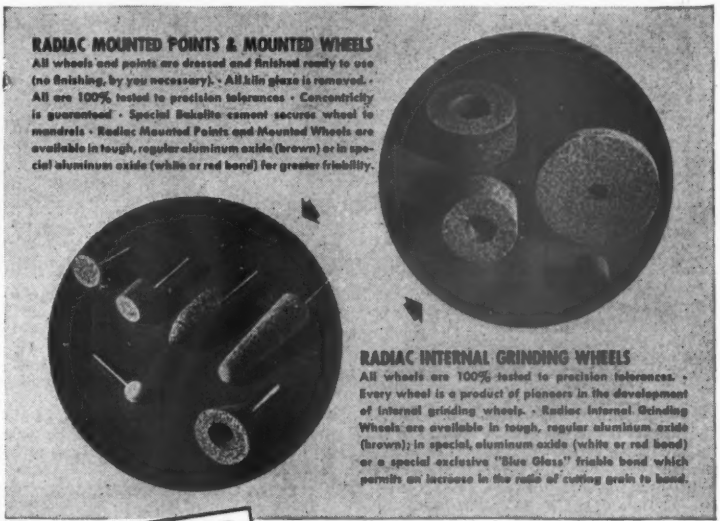
PERFEX DRESSER CORPORATION
3607 GAYLORD . DETROIT, MICHIGAN

RADIAC*

MOUNTED POINTS, MOUNTED WHEELS AND INTERNAL GRINDING WHEELS

[*Right* for the job! They *stay right* because they're prescription-fitted and custom-compounded.]

No question about getting the right Radiac wheel for your job. Each Radiac wheel is "prescription-fitted" for your purpose and custom-compounded. Each "prescription" is carefully recorded so that repeat orders can be exactly duplicated. Radiac is right . . . and right every time! Write for booklet with complete details on Internal Grinding Wheels (booklet #1) and Mounted Points (booklet #2).



RADIAC MOUNTED POINTS & MOUNTED WHEELS

All wheels and points are dressed and finished ready to use (no finishing, by you necessary). • All kiln glaze is removed. • All are 100% tested to precision tolerances • Concentricity is guaranteed • Special Bakelite cement secures wheel to mandrels • Radiac Mounted Points and Mounted Wheels are available in tough, regular aluminum oxide (brown) or in special aluminum oxide (white or red bond) for greater friability.

RADIAC INTERNAL GRINDING WHEELS

All wheels are 100% tested to precision tolerances. • Every wheel is a product of pioneers in the development of internal grinding wheels. • Radiac Internal Grinding Wheels are available in tough, regular aluminum oxide (brown); in special, aluminum oxide (white or red bond) or a special exclusive "Blue Glass" friable bond which permits an increase in the ratio of cutting grain to bond.

PIONEERS in the development of mounted points, mounted wheels, and internal grinding wheels.

For Fast Stock Removal, Long Life, Cool Cutting—

RADIAC*

Radiac POR-OS-WAY — Radiac PARAFLEX — Radiac Mounted Points and Mounted Wheels — Radiac Internal Grinding Wheels — Radiac Abrasive Cut-Off Machines and Discs.

A. P. DE SANNO & SON, INC., 484 Wheatland Street, Phoenixville, Penna., Since 1893

NEW YORK • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • LOS ANGELES

*T. M. Reg. U. S. Pat. Off.

Copyright, 1944, A. P. de Sanno & Son, Inc.

More MASONITE* DIE STOCK means less weight, time and cost

A great deal of Masonite Die Stock is used in this jig for assembling the nose cowl of a plane at Fairchild Aircraft, Division of Fairchild Engine & Airplane Corporation.

WHEN you use Masonite Die Stock in assembly fixtures, you win three different ways. You save *weight—time—costs.*

This amazing semi-plastic material is only one-sixth the weight of steel. Yet it acts like metal in that it helps solve problems relating to dimensional stability, rigidity, torque and deflection.

You save time and money with Masonite Die Stock because this material, thickness for thickness, is a fraction of the cost of metals—because of the speed with which it can be worked with either metal-cutting tools or with high-speed pattern shop equipment.

Today, you find this modern die stock widely used in aircraft plants throughout the country. And it has also become a prime favorite of other fabricators of thin-gauge metals who want to do a *faster, better job at less cost.*

Masonite Die Stock is available in thicknesses of ¼ to 2 inches... in sizes of 48 x 72 inches and 48 x 144 inches. Get acquainted with this remarkable material at once. Simply fill out and mail the coupon.

*TRADE-MARK REG. U. S. PAT. OFF.
COPYRIGHT 1944, MASONITE CORP.

Awarded to Masonite Corp. plant at Laurel, Miss.

MASONITE CORPORATION
Dept. TJ-5, 111 W. Washington St., Chicago 2, Illinois

Please send me illustrative literature and complete information about Masonite Die Stock.

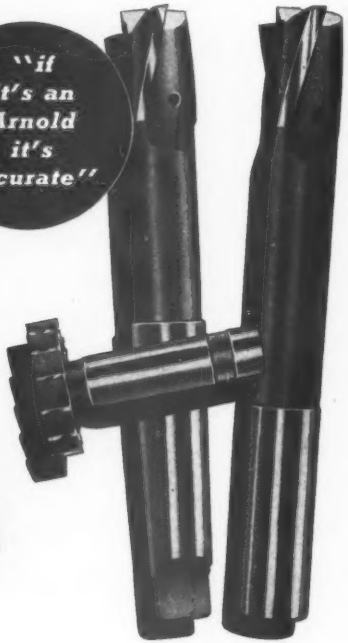
*Name and firm*_____

*Address*_____

*City*_____ *State*_____

Quick Delivery OF QUALITY CUTTING TOOLS

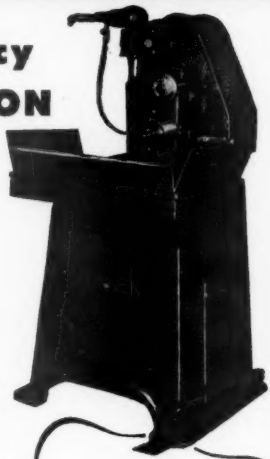
"if it's an Arnold it's accurate"



Many of America's leading manufacturers have learned that most of the quality cutting tools listed in the new Arnold catalog can reach them surprisingly fast. For instance, three types on which you can expect almost immediate delivery are illustrated above. They are: counterbores, straight and taper shank with interchangeable pilots and Woodruff key seat cutters. Arnold's thirty years of toolmaking experience can provide you with cutting tools that can be depended upon for maximum efficiency, service and accuracy. If you do not have our new 40 page catalog containing the complete Arnold line, send for it at once. No obligation.

ARNOLD
Tool Company
14469 EUCLID AVE.
EAST CLEVELAND 12, OHIO

Here's What the Accuracy of the SUNNEN PRECISION HONING MACHINE Means to YOU!



✔ **ABSOLUTE INTERCHANGEABILITY**—Because tolerances can be held to within .0001". In fact, accuracy has been held to within .000025" on production jobs. Holes are honed straight and true, without taper or bell-mouth.

✔ **LONGER LASTING PARTS**—Because it produces a super-smooth finish of from 2 to 3 micro-inches. Bearings, bushings, sleeves, etc., run more smoothly; they can be fitted more closely. The smooth base metal finish, free from high spots, makes parts last longer because they wear more slowly.

In addition, the Sunnen Precision Honing Machine is easy to set up—usually taking less than one minute. Skilled labor is not needed. It's practical, inexpensive, and easy to operate.

Write for free bulletin — or ask a Sunnen engineer to give you complete information on how Sunnen Honing can be used in your plant.

The Sunnen Precision Honing Machine handles any internal diameter from .185" to 2.625" in any metal or plastic except lead or babbit. Accuracy is guaranteed within .0001".

Typical Jobs

Hydraulic Control Bushing. Honing gives straight round hole after rough reaming.

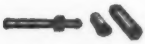
Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Cast Iron Valve Stem Guide. ½ to one thousandth removed — 220 pieces per hour. Better finish and straighter hole.

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

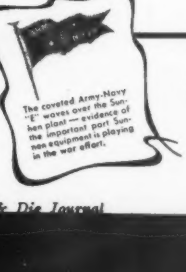
Shell Loading Die.



Airplane Engine Parts accurately honed to a super-smooth finish.

Compressor Yoke. Alignment maintained and better finish produced.

Aircraft Carburetor Operating Valve Sleeve. Sunnen honing eliminates distortion from assembling operation.


The coveted Army-Navy "E" waves over the Sunnen plant — evidence of the important part Sunnen equipment is playing in the war effort.

SUNNEN

SUNNEN PRODUCTS COMPANY

7947 Manchester Ave., St. Louis, Mo.

Canadian Factory, Chatham, Ontario

Choose the
Center with the

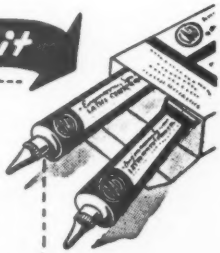
Helical Groove

CMD

Longer running time between replacements

To make machines run longer before requiring attention to centers — choose the center with the helical groove — made only by CMD. The exclusive advanced design, with the left-hand Helical Groove, assures more complete and longer lasting lubrication of point and work. No more burned-out center points! No stopping machine to relubricate center! No readjustments of tail stock! When CMD Helical Groove Centers are lubricated with CMD Center Point Oil, running time is frequently increased as much as 1500 per cent.

Write for* FREE *Sample Kit



CHICAGO MANUFACTURING & DISTRIBUTING CO.
Dept. 5J, 1928 West 46th St., Chicago 9, Ill.

Send circular on CMD Helical Groove Centers.

Without obligation to us, send FREE sample kit containing a tube of CMD CENTER POINT OIL and a tube of CMD CENTER POINT LUBE (grease) with directions for making an amazing, simple test.

NAME .....

FIRM NAME .....

ADDRESS .....

YOU HARDEN IT

WE'LL DRILL IT

"HARDSTEEL" DRILLS SPEED THE DIES FOR THE WINGS OF TOMORROW...

"HARDSTEEL" drills in thousands of plants are speeding die production—drilling hardened dies when last minute engineering changes call for holes in new locations or for additional holes—saving both critical materials and countless man-hours.

For fast, accurate drilling of steel hardened by any process to Rockwell "C" 40 or harder, there is only one answer —"HARDSTEEL," the three-cornered drill made from a special alloy material that can be reground quickly on any wheel.

"HARDSTEEL" is also available in reamers, tool bits and special tools. These tools are setting excellent production records on tough, hard-cutting steels and abrasive non-ferrous alloys.

Complete data on "HARDSTEEL" tools is contained in the "HARDSTEEL" Operator's Manual, together with instructions for using and many illustrations showing both parts recovery and production operations. Copy free on request.

BLACK DRILL COMPANY

1400 EAST 222nd STREET • CLEVELAND 17, OHIO

"HARDSTEEL"

DRILLS · REAMERS · TOOL BITS · SPECIAL TOOLS

A corner of the Colonial Heat Treat Department.

How to get more out of your Broaches------

BY PROPER HEAT-TREAT

The difference between an ordinary broach and a really good one is frequently traceable to the heat-treatment before grinding. Of course, you can't take all your broaches and heat-treat them yourself for longer life. But you can make sure that they are properly heat-treated.

One of the best ways to do this is to check into your broach supplier's heat treating equipment.

As a starter, we will be glad to tell you about our new, modern and complete Heat Treat Department. It will give you an idea why Colonial Broaches do such an outstanding job.

Ask for a copy of Broaching News—Vol. V, No. 2.

colonial BROACH COMPANY
DETROIT 13, U.S.A.

Broaches Broaching Machines - Broaching Equipment

Some of the vertical and horizontal Heat Treat Furnaces at Colonial.

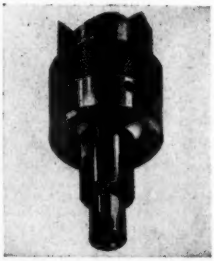
- - The Patented Collet assures the Precision of

Models 102 and 402 Chucks in use on Automatic Screw Machine.

Main and auxiliary turrets equipped with Erickson Chucks. Note short drill overhang, taps and reamers.

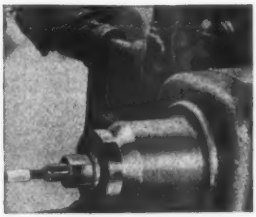
Collapses 1/32 in.—Retains Gripping Strength and Accuracy.

Collet open at both ends.



Model 201 High Speed Router Chuck with extend nose piece for pattern following.

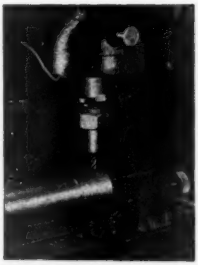
Horizontal Miller with 102 Chuck used to hold Woodruff Key Cutter.



Model 301 Chuck designed for high speed internal grinding operations.

Model 102 Chucks for drilling and tapping operations on Turret Lathe. Jobbers Drill stubbed on chuck in foreground.

Tool Post Grinder equipped with Model 301 Chuck.

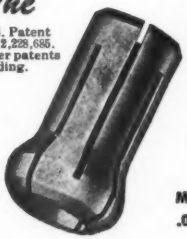


Vertical Milling operation with 101 Chuck.

ERICKSON STEEL COMPANY

The

U. S. Patent No. 2,228,685. Other patents pending.



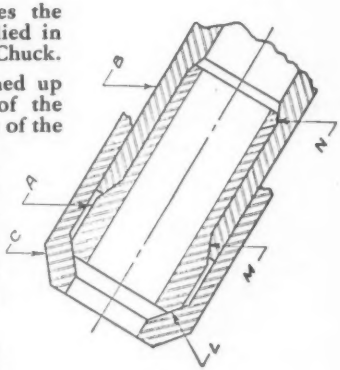
ERICKSON PRECISION COLLET CHUCK

Model "01" accurate within .0005 or less at the nose.

Model "02" accurate within .001 or less at the nose.

PRINCIPLE

The drawing (right) illustrates the revolutionary principles embodied in the Erickson Precision Collet Chuck.



Collet "A" is automatically lined up concentrically with the axis of the Shank "B" by two Cam Surfaces of the Collet "M and N" mating with the Cam Surfaces of Shank. The Shank and Collet Cam Surfaces are mated to within .0001 inch.

This action aligns Collet with the Axis at the Center of Shank, allowing it to be drawn back by Collet Cam Surface "L" and Nose Piece "C".

Due to the fact that collet is open slotted at both ends, Collet "A" then collapses equally throughout its length to maintain a vise-like grip and remain in perfect alignment with the Axis of Shank.

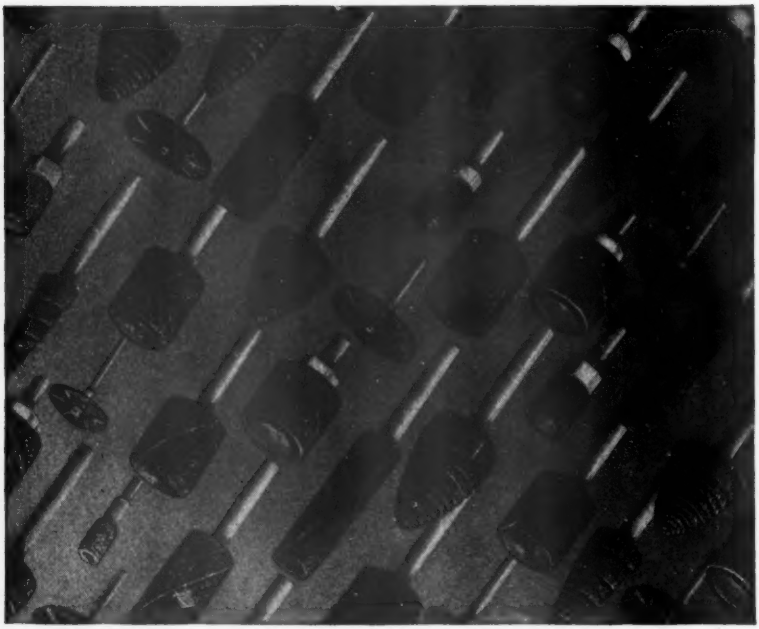
SEND FOR BULLETIN "E"

Model 402 Chuck in use on Automatic Screw Machine. Drill gripped on flutes.

One ERICKSON COLLET will replace 7 standard, single purpose Collets.

Special Model 202 Chuck used in Hand Drills in Aircraft Industry. 01 Models are regularly recommended for Hand and Air Drills.

Dept. H 2309 Hamilton Ave., CLEVELAND 14, O.



PICTURE THESE AT 20,000 r.p.m.

You can easily sense what these ready-to-use METALITE Cloth Gadgets will do on the business end of your high speed tools compared to a strip around a workman's finger or held loosely in his hand.

At speeds up to 20,000 r.p.m., isn't it obvious that they will do in seconds what now takes minutes by old-fashioned methods?

For burring, putting on radii, getting into all sorts of odd shaped "difficult-to-get-at" places and for many other bothersome, time-consuming operations, METALITE GADGETS will save time and money and contribute greatly to smoother, better production.

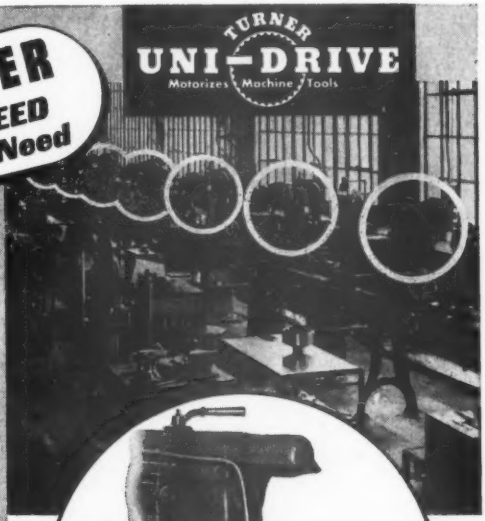
But, from the hundreds of sizes, shapes and grits, don't try to pick the one you think will do the job. We'll do better than that for you. A Field Engineer will tell you the best one for each specific operation and demonstrate on the toughest jobs you dig up for him. Simply call our nearest branch.

Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New York, Philadelphia, St. Louis, San Francisco, Tacoma.

BEHR-MANNING (DIVISION OF NORTON COMPANY) **TROY, N. Y.**

PACE SETTER
Where SPEED Is a Vital Need

TURNER
UNI-DRIVE
Motorizes Machine Tools



–Increasing Production
–Lowering Costs In Hundreds of Plants Like These:

American Brake Shoe & F. Co.
Kellogg Division
Southern Wheel Division
Augusta Arsenal
Bendix Aviation Corp.
Brown-Lipe-Chapin
Division General Motors
Cessna Aircraft Corporation
Chicago, Rock Island & Pacific R. R. Co.
Chicago Screw Company
Delco-Remy Co.
Division General Motors
Doehler Die Casting Co.
Electric Auto-Lite Co.
Frankfort Arsenal
Frisco Lines
Holtzer-Cabot Elect. Co.
Imperial Brass Mfg. Co.
International Projector Co.
Kohler Corporation
Monsanto Chemical Co.
The New York Air Brake Co.
Ohio Pattern & Foundry Co.
Oneida, Ltd.
Parker Appliance Co.
Republic Steel Corporation
Revere Copper and Brass, Inc.
SKF Industries
The Timken-Detroit Axle Co.
The Todd Company
Wagner Electric Co.
W. A. Shaeffer Pen Co.

Outstanding Jobs on Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools. Also for Brown & Sharpe and Cleveland Automatic Screw Machines.

● It is actually keeping users ahead of schedules by increasing production up to 25% to 300% and slashing costs. No belts to shift—drives to large step of cone at all speeds. Eliminates overhead line and countershafts. All advantages of geared head with belt drive smoothness. See your dealer or write for details.

THE TURNER UNI-DRIVE COMPANY
(Sales Division: Turner Machinery Co.)
3416 Terrace Street **Kansas City, Mo.**

NOW AT WORK FOR VICTORY ★★★

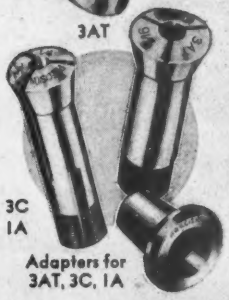
PRODUCING MACHINE TOOL DRIVES • AIRCRAFT FITTINGS

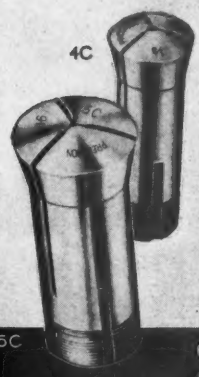
WHEN COLLET WORK IS INDICATED - SPECIFY

Precision Collets

For 10" ATLAS & LOGAN, SOUTH BEND, SHELDON, CRAFTSMAN, POWR-KRAFT, CLAUSING and other important lathes.

IMMEDIATE DELIVERY FROM STOCK

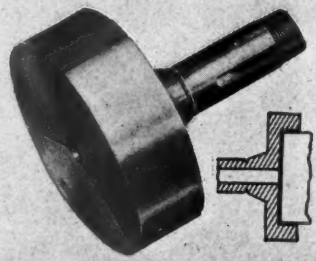




The *Precision* name on a collet is your unconditional guarantee of accuracy in machining, hardening and grinding. Make sure then to specify *Precision* when ordering from your dealer. Literature on request.

- MODEL 3AT: For 10" Atlas, Logan, 12" Craftsman, No. 700 Powr-Kraft.
- MODEL 3C: For 8" & 9" South Bend, Clausing, Hardinge No. 3, 10" LeBlond, etc.
- MODEL 1A: For 8" & 9" South Bend.
- MODEL 5C: For 9", 10", 16", 18" South Bend, 1" capacity Sheldon, Schauer, Sebastian, etc.
- MODEL 4C: For 14½" South Bend, ¾" capacity Sheldon, Hardinge No. 4, Elgin, etc.
- MODEL 480: For Logan Screw Machine, Turret Lathe and attachments; Warner & Swasey No. 1, etc.
- BREN Collet: For Handwheel & Lever-Type Speedichuk.

KLUTCH - KOLLET (Step Chuck) for chucking work to 2¾" diameter with collet accuracy. Head unhardened for easy boring. Fits 3AT, 3C, 1A adapters only. List unbored $7.50 each.



GENERAL DIE-STAMPING-TOOL COMPANY

PRECISION COLLET DIVISION 265 Canal Street, New York 13, N.Y.

POWER *IS* AS POWER *DOES!*

20" DRILL PRESSES —Bench and floor models. Hand or power feed. Spindle speeds 260 to 5200 r.p.m.

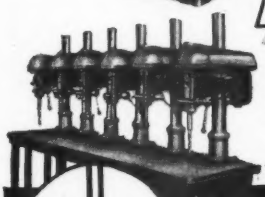
RADIAL DRILLS — Drill to center of 62" circle. Spindle speeds 160 to 8200 r.p.m.

METAL CUT-OFF MACHINES—Ball bearing sliding ram travels 21½". Cuts all types of materials at any angle.

Not a pound, not a horsepower "loafs" in a Walker-Turner Machine Tool. Thoughtful design and careful selection of materials have made them flexible, versatile and stream-lined—yet rugged and accurate. And most of them operate on minimum horsepower requirements.

They are substantially increasing production on thousands of machining operations, involving materials from steel to plastics. They are scoring marked savings for their users in capital investment, operating costs and power consumption. If you're interested in advantages like these, write for our catalog today.

WALKER-TURNER COMPANY, Inc.
PLAINFIELD, N. J.



20" MULTI-SPINDLE DRILL PRESSES—2, 4, 6-spindle models. Hand or power feed.

BAND SAWS — 14" and 16" models. Speed range from 61 to 5300 s.f.m.

walker-Turner
COMPANY, INC.
PLAINFIELD, N.J.
U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

5-2

GORTON

SPECIALISTS FOR OVER 30 YEARS

Tracer-Controlled MILLING

Automatic *Rotation PROFILING

* WORK and MASTER ROTATE with TABLE MOVEMENT

CYLINDRICAL Interrupter Cam for Gun-Fire Control

A Typical HIGH PRODUCTION Profiling Job—done on the Gorton 9-J Duplicator. 10 elliptical wells—no two the same size—on each of these cylindrical work pieces are rough and finish milled, with beveled edges—simply by combination of Tracer Control, with Automatic Rotation of work and master, geared to table movement—all controlled by one central lever motion.

Blank cylinders come to the Gorton Duplicator, finish-turned. The 10 wells are first rough milled to a depth of .052". Then a finish cut, with the same cutter and spindle speed, removes .010" stock, merely by lowering spindle the required amount. Hand finishing required is almost negligible—due to the excellent finish obtained by the use of 2-flute Tungsten Carbide form cutters—at Gorton high spindle speeds.

PRODUCTION DATA

Material—S.A.E. 1020 Seamless Steel Tubing.
Operation—Rough and Finish Milling of 10 Wells (varying from ¾" wide x ⅜" long . . . to 3⅛" wide x 2" long), .062" deep.
Cylinders—9⅜" O.D. x 7²⁵⁄₃₂" long.
Feed—Manual . . . Spindle Speed—4,000 r.p.m.
Tolerances—±.005"
Time—Roughing 18 minutes; finishing 23 minutes; total floor-to-floor, 43 minutes. (10 wells complete, average 4.3 min. per well.)

ENGINEERING SERVICE . . . FREE

Have the advantage of 50 years of Gorton Specialized Tracer Control Experience in your shop—call nearest Gorton dealer or write to Gorton factory at Racine, Wisconsin.

The Right Size The Right Type of Machine for Every Job . . .
From 2 oz. to 2 ton DIE BLOCKS

Tracer-Controlled MILLING

Tracer-Controlled DUPLICATING

Tracer-Controlled ENGRAVING

Tracer-Controlled MOTIFS

GORTON Precision MACHINES

CUTTER GRINDERS

ETCHING MACHINES

2 & 3 Dimensional PANTOGRAPHS

Vertical & Universal Head Super-Speed MILLERS

Manual & Electric Control DUPLICATORS

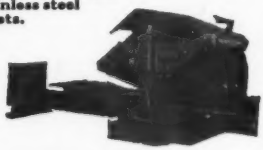
TEAR OFF COUPON AND MAIL TODAY

George Gorton Machine Co.,
1205-13 Racine St., Racine, Wis.
Send me these free books
☐ Condensed Catalog
☐ Die and Mold Duplicators

Name..... Title.....
Company.....
Address.....
City..... State.....

MATTISON
ABRASIVE BELT GRINDING AND POLISHING MACHINES

Mattison W-455 Wide Belt Grinding and Polishing Machine for finishing of wide stainless steel sheets.



Mattison J-135 Idler Stand and Pulley adapts regular polishing Jack to the use of factory-coated abrasive belts.

Mattison J-115 Variety Belt Grinding and Polishing Machine for flat and curved surfaces.

Mattison L-138 Grinding and Polishing Machine arranged for wet grinding.

★ Results obtained in a number of plants definitely establish the use of factory coated abrasive belts as a most efficient practice. Besides reducing the number of rejections and improving the finish, they have cut the polishing cost per piece through increased production.

However, to secure full benefit from factory-coated abrasive belts, the right type of mechanical unit is necessary. The machine is all important for properly applying the abrasive to the particular job to be done.

Mattison Abrasive Belt Grinding and Polishing Machines are engineered with a knowledge of the factors involved to give the best application of belts. From the time factory-coated abrasive belts were introduced for metal grinding and polishing, Mattison's have developed and built machines to provide best results.

Mattison Abrasive Belt Grinding and Polishing Machines are used for smoothing up welding marks, polishing solid parts—such as handwheels, levers, handles, steel sheets including stainless steel—and the inside of tubes. They are built for both the wet and dry grinding method. In addition to the finishing of metal parts, they are used for plastics, hardened rubber, fibre, glass, etc. In fact, the applications are so numerous, only a few can be mentioned onand shown on this page.

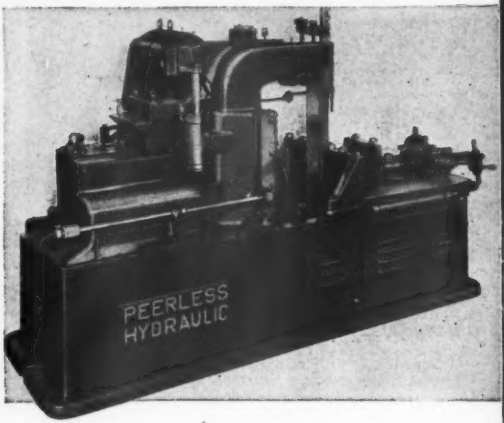
Whatever your problems may be, it is well worth while to make an investigation as to the machine available for handling it.

SEND FOR *FREE* BOOKLET

Illustrates various applications of Mattison Grinding and Polishing Machines, built to to secure best results from factory coated abrasive. belts. Also gives helpful data on grinding and pol ishing metals, plastics and other materials with abrasive belts. Write today for your copy.

MATTISON MACHINE WORKS—ROCKFORD, ILLINOIS

Large, squarely-cut scrap pieces can be used to make shearing dies, other die blocks, strippers and stripper plates.



WITHOUT EQUAL FOR DIE AND TOOL MAKING!

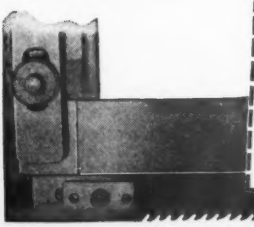
Only the Peerless Heavy Duty Vertical Hydraulic Saw cuts 10x24-in. tool stock without turning the work. Capacity with standard vise jaws is 16x16-in. In cutting tangs in die blocks, work can be positioned at any angle. As little as 1/32-in. is left for planing. Waste is negligible.

On worn dies, a truing cut can be taken quickly with the Peerless Vertical. Test samples are cut with minimum waste as the cut is square and true all the way through.

A large balancing cylinder offsets weight of saw-frame. Stock rollers raise and lower work hydraulically. Blade clears work on return stroke and a steady flow of coolant washes chips into tray for easy salvaging. Get an estimate of cutting time on your toughest operation. See how the Peerless Vertical meets wartime and postwar needs. Mail the coupon now.

PEERLESS MACHINE COMPANY, 1600 Junction Avenue, Racine, Wisconsin

Builders of Fine Tools for Thirty Years



PEERLESS MACHINE CO., TDJ-544, Racine, Wis.

- ☐ Mail catalog covering Vertical type used for Die Block Work
- ☐ Mail catalog on Hydra-Cut Saw for High Production Cutting
- ☐ Mail catalog on Mechanical type Saw for production cutting
- ☐ Mail catalog on general utility and maintenance Saws

Company_____

Individual_____

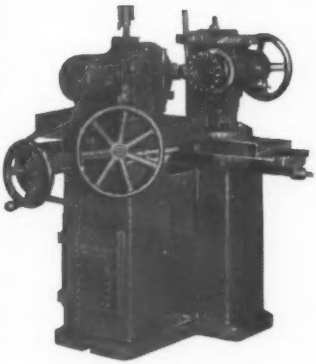
Street_____

City_____ State_____

. . . Assure a Greater Return From Your Milling Machine Investment

Avoid waste of valuable productive time by constant changing of face mill cutters. The Milwaukee Face Mill Grinder sharpens each tooth accurately — makes cutters last longer — require less frequent re-grinding — decreases "down-time" on your milling machines.

An indispensable machine of strength, precision and capacity, the Milwaukee Grinder grinds Tungsten Carbide and other cutters, ranging from 3 inch to 16 inch diameters, to within .0002 runout — and does it fast.



MILWAUKEE FACE MILL GRINDER FEATURES:

- Unusual Rigidity
- Accuracy to within .0002 runout
- Finger-tip controls — handily located for simplified operation
- Design and performance of the Milwaukee substantially reduces sharpening time
- The three-bearing dynamically balanced grinding wheel spindle rotates at 3400 r.p.m.; heavy flywheel keeps abrasive wheel up to full grinding speed — maintains accurate uniform cutting action — each tooth perfectly ground.

- Set-ups quickly made with graduated dial, facilitating quick adjustments

For complete information write for Bulletin 41-A

Rotary Head Milling Machine
Autometric Jig Borers
Center Scope

Kearney & Trecker Products
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
Milwaukee Midgetmill
Milwaukee Speedmill

CONSERVE PRECIOUS TOOLS

With CIRCULAR RELIEF GRINDING!

ONE MACHINE is all you need to grind your valuable tools *the right way*... without needlessly grinding away metal that supports the cutting edge of the tool.

CIRCULAR RELIEF GRINDING *follows the contour* of the tool, leaving maximum support behind the cutting edge and contributing to longer tool life.

ONE OPERATION and one machine, instead of four operations and two machines... that's the CIRCULAR RELIEF way! It saves you time and labor as well as tools and money. Send for the free circular and get the whole story. You'll be glad you did!

CIRCULAR RELIEF GRINDING
ONE OPERATION—NO "LAND"
TWO OPERATIONS LEAVE "LAND"
THREE OPERATIONS LEAVE "LAND"
Comparing CIRCULAR RELIEF With Conventional Grinding

Note from diagram how CIRCULAR RELIEF GRINDING *follows the curve* of the tool, grinds right up to the cutting edge, and does not cut away valuable metal supporting the cutting edge.

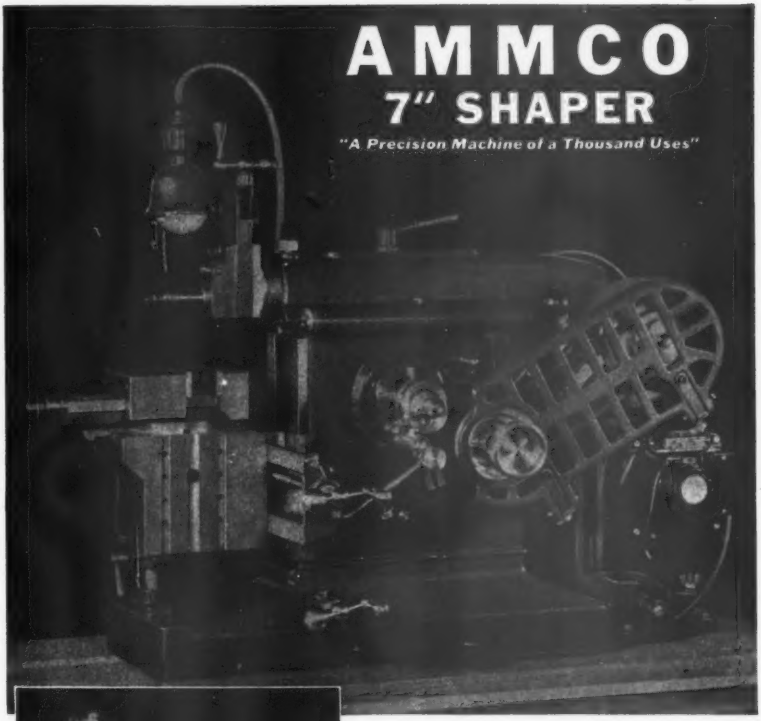
Send for Complete Information!

CLEVELAND

TOOL ENGINEERING COMPANY

1261 W. Fourth St. **Cleveland 13, Ohio**

AMMCO
7" SHAPER
"A Precision Machine of a Thousand Uses"



IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just wheel up to bench--plug in--and go to work!**

On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

Portable Cabinet model enables this shaper to be moved about the shop.

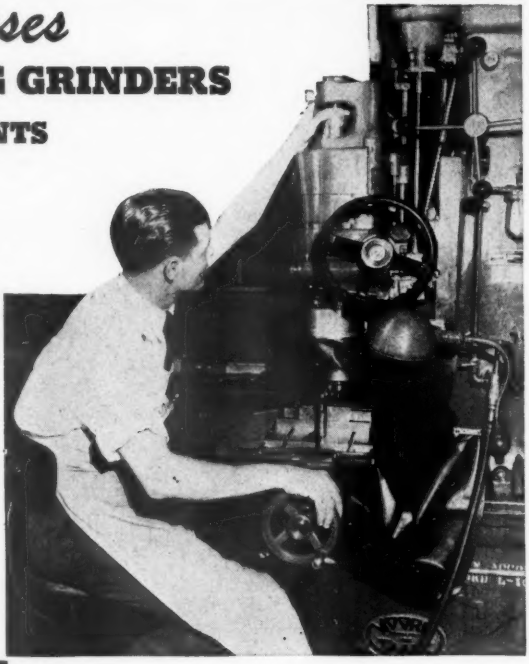
May be purchased on M.R.O. priority.

Write today for specifications and prices

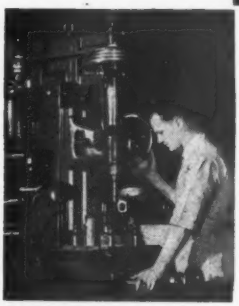
ARMY E NAVY

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Ave.—North Chicago, Illinois, U. S. A.

BENDIX *uses*
MOORE JIG GRINDERS
in FIVE PLANTS



FOR the micro-fine accuracy demanded of their products, Bendix Aviation Corporation uses Moore Jig Grinders in at least five of their vital plants throughout the country—Bendix Westinghouse, Elmira, Teterboro, Philadelphia and South Bend. It was precisely for these extra tolerance requirements that the Moore Jig Grinder was created—a precision tool that corrects hole location and grinds within less than .0001" on dies, drill jigs, master plates, gages and production parts.



Photos Courtesy Bendix Aviation Corporation

○○○ AND MOORE JIG BORERS TOO!

As a "Partner in Production" to the Moore Jig Borer, Moore engineers created the Jig Grinder. Both use the basic Moore system of Coordinate Location, the most scientifically accurate and rapid method of hole location in jigs, dies, and fixtures yet developed. Operating by means of precision-ground lead screws, the coordinate system makes routine the spotting, drilling, reaming and boring in one uninterrupted sequence—whether in the hands of semi-skilled or highly skilled operators. The Moore Jig Borer is highly sensitive for holes of ½" diameter, yet rugged for heavy cuts up to 4½" and consistently holds to a tolerance of .0002". The Moore Jig Grinder corrects and finishes jig-bored holes on both hard and soft work within .0001".

Judge Us By the Company We Keep

MOORE SPECIAL TOOL COMPANY INC.
740 UNION AVENUE, BRIDGEPORT 7, CONN.

Heat Treat

Your Own Small Parts...

SAVE TIME AND MONEY THESE 5 DIFFERENT WAYS

This small compact electric furnace is inexpensive, handy and easy to operate—ideal for small tool and die shops—saves time these five different ways:

1. Eliminates delays in sending small machine parts out to overcrowded commercial heat treaters.
2. Saves time and expense of drawing or tempering small metal parts in large furnaces.
3. Cuts handling time when normalizing or annealing small parts. No waiting.
4. Conveniently available for pre-heating for subsequent high-speed hardening.
5. Eliminates shut downs and delays in servicing emergency repair orders.

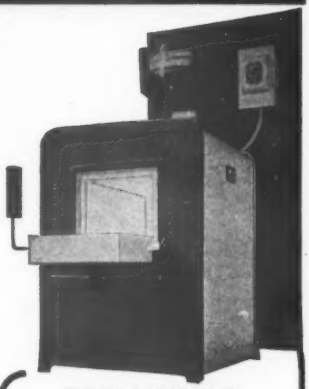
AVAILABLE IN TWO SIZES

Type	*Chamber Capacity*	*Amps 115 V*	*Watts*	*Amps 230 V*	*Price*
MH-3	8"W 6"H 14"L	29.6	3400	14.8	$124.00*
MH-4	10"W 6"H 18"L	....	4800	20.9	$191.00*

**Includes Hearth Plate*

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—$152.40.

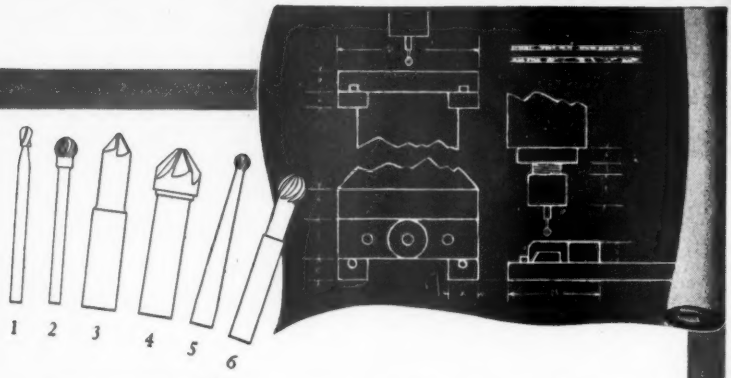


REPLACEABLE HEATING ELEMENTS

Replaceable nickel chromium resistors embedded in rectangular refractory blocks. Elements form inner walls of furnace chamber, and may be replaced easily and quickly after removing rear panel — furnace structure remains undisturbed.

FREE—Complete data covering specifications, additional applications and ordering instructions are included in this new folder. Write for your copy today. Ask for Bulletin No. 50.

COOLEY ELECTRIC MANUFACTURING CORP.
32 SOUTH SHELBY STREET · INDIANAPOLIS 7, IND.



TO YOUR SPECIFICATIONS

Carbide-tipped ROTARY CUTTERS

We are now equipped to turn out custom-made CARBIDE Rotary Cutters to meet your most exact requirements—precision ground for precision performance. Send your sketches or blueprints to M. A. Ford Mfg. Co. Inc., 739 W. First St., Davenport, Ia. No obligation of course.

(1) Carbide end mill—1/8" diam. —1/16" radius end.
(2) Carbide ball—1/4" diam. 1/8" shank, 2 3/4" overall length.
(3) Carbide end mill—2 flute, RH operation.
(4) Carbide chatterless countersink—3/8" shank.
(5) Carbide ball—3/16" diam. 1/4" shank, 3 1/4" overall length.
(6) Carbide ball—precision ground .375" diam. (+.0000 / −.0002)

Ask for your copy of catalog showing our standard line of Carbide Cutters.

FORD

The mark of a GOOD File

FEDERAL

Taperlock PLASTIC GAGE HANDLES

MADE of light weight plastic material, Federal Gage Handles are lighter than any metal used, even one-third lighter than aluminum. This lightness permits a most sensitive "touch" with less fatigue in long continued use; an advantage appreciated by women inspectors.

They are highly satisfactory with glass gages; being so much lighter than metal handles, they reduce the danger of chipping and breakage.

Insulating properties help prevent transmission of bodily heat to gages which may affect accuracy.

Marking for identification is accomplished with the same marking tools used for metal gages.

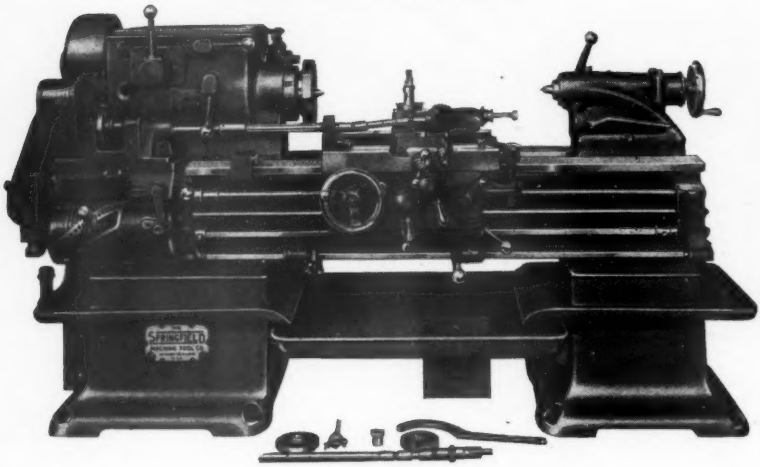
Immediate Delivery

SEVEN SIZES AND COLORS
00, 0, 1, 2, 3, 4, & 5—in Red, Green, Yellow, Black

FEDERAL TOOL CORPORATION
400 NORTH LEAVITT ST., CHICAGO, ILL.

SPRINGFIELD PRECISION LATHE

Out in front!



● Headstock . . . twelve speeds . . . only half of the easy-shifting spur gears mesh at one time.

Motors . . . V-Belt or silent chain drive.

Bed . . . permanently true—made of high test alloy to resist warp or marring under severe service.

Apron . . . extra heavy—operates on Ball and Bronze bearings throughout.

Taper attachment . . . hair-trigger adjustment.

Compound rest . . . sturdy, firm.

Tailstock . . . all bearings and bed ways oiled from one well.

From headstock to tailstock—the SPRINGFIELD Lathe is *out in front!*

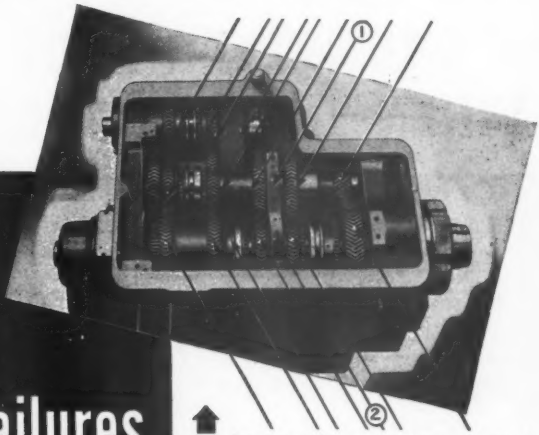
SEND TODAY FOR BULLETIN No. 163

Tells the why and how of Springfield's accurate production.

THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD • OHIO, U. S. A.

Guarded against costly failures



Headstock of Sidney Lathe. Numerals 1 and 2 point to center bearings; other arrows indicate 14 Ampco bushings in the gears.

. . . with bushings and center bearings of wear-resisting Ampco Metal . . .

Reg. U. S. Pat. Off.

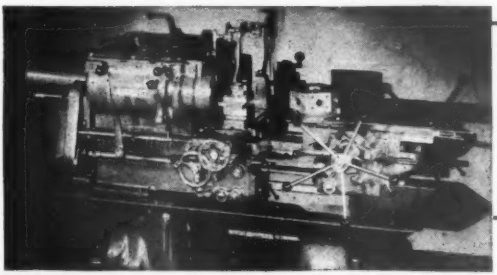
AMPCO Metal

The Metal without an Equal

When you buy machine tools or other heavy equipment, it pays to check for parts of Ampco — the metal that stands up and gives several times the life of ordinary bronzes. Adopted by 90-odd leading machine tool manufacturers. • Write for bulletins which will aid you as a buyer and user of machinery — or help you specifically with your design problems involving wear, corrosion, shock, or other severe conditions.

Ampco Metal, Inc.

Department TD-5 **Milwaukee 4, Wisconsin**



For replacements When you experience the failure of bronze parts, replace them with Ampco. Ask nearest Ampco Field Engineer for suggested procedure and Ampco Metal stock list to fit the specific needs of your Maintenance Department.

Ampco has long been standard with the Gisholt Machine Co.

[Tear out and mail coupon today]

AMPCO METAL, INC., Dept. TD-5
Milwaukee 4, Wisconsin

Please send
☐ File 41—Engineering Data Sheets
☐ Information on Maintenance Uses

Name..... Position.....
Company.....
Address.....
City..... (.....) State.....

WHAT TO LOOK FOR WHEN YOU BUY GAGE BLOCKS

1. DIMENSIONAL ACCURACY:
Gage blocks must have their surfaces flat—parallel and all dimensions accurate as indicated. Rigid inspection of every Webber Gage block insures its dimensional accuracy.

2. STABILITY:
The steel in gage blocks must be stable—not change size. After long years of research—Webber has developed a steel and method of treatment which guarantees against changing size for any reason except normal wear.

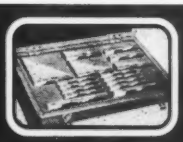
3. SURFACE FINISH:
Fine finish is necessary to provide maximum accuracy—reduce wear and improve wringing. Webber Gage Blocks are given the finest finish commercially possible to put on steel.

4. WEARING QUALITY:
Gage blocks must be able to stand up under normal usage without showing excessive wear. Performance records prove that Webber Gage Blocks have exceptional "wearing quality."

and SERVICE after the sale!

Webber Gage Blocks not only assure dependable precision measurements on the various steps of production from tool room to assembly but Webber service provides complete facilities for the inspection—reconditioning—and replacing of worn or damaged blocks at a moderate cost. Webber service also includes a selection of the following sets—

Set No. 84A—$350.00		Set No. 84B—$235.00	
Set No. 43A— 185.00		Set No. 43B— 150.00	
Set No. 38A—(Thin Blocks)	$195.00		
Set No. 38B—(Thin Blocks)	155.00		
Set No. 14A—(Angle Blocks)	450.00		



Webber GAGE COMPANY
12903 TRISKETT RD. • CLEVELAND 11, OHIO

CHICAGO
MOUNTED WHEELS and Small GRINDING WHEELS

A complete range of styles, grains and sizes up to 3" in diameter to give you a perfect finish on every job.

PROMPT DELIVERY

Specialization—with full WPB approval—on sizes 3" in diameter and under, means no waiting for Chicago Grinding or Mounted Wheels. Let us take care of your present and post-war requirements.

FREE
ENGINEERING ANALYSIS

If you have a grinding job that presents a problem because of the nature of material, tricky shape or other reason, tell us about it. Our experts will go into a huddle and give you the benefit of our long experience making millions of custom built wheels for every conceivable operation.

YES, YOU CAN FINISH IT BETTER WITH A CHICAGO WHEEL

Half a Century of Specialization has Established our Reputation as the Small Wheel People of the Industry.

Just as the prelude to a new world is better tools of war, so the prelude to a perfect finish is better grinding wheels. Today's standards of finishes are far and beyond those of yesterday. To acquire them without sacrifice of production time is a goal which everyone seeks.

Finish must now be measured in micro inches. That's where the new Chicago FV BOND Wheels excel. They give a precision smoothness so intensified that it passes any surface analyzer test, in many cases eliminating hand lapping and auxiliary finishing operations.

HERE'S WHAT MAKES CHICAGO WHEELS CLICK:

A—Sensational new FV BOND. Result of research and experiment on hundreds of aircraft jobs.
B—No sacrifice of cutting time or wheel life.

FV BOND is available in all types of Chicago Mounted and Small Grinding Wheels—in all abrasives, grain and grade combinations.

TEST WHEEL FREE — To prove their superiority in your own shop, send for a Chicago Wheel made with FV BOND. Give us details of the job, material you want to finish and we'll do the rest.

Write for Catalog and interesting Engineering Survey Form

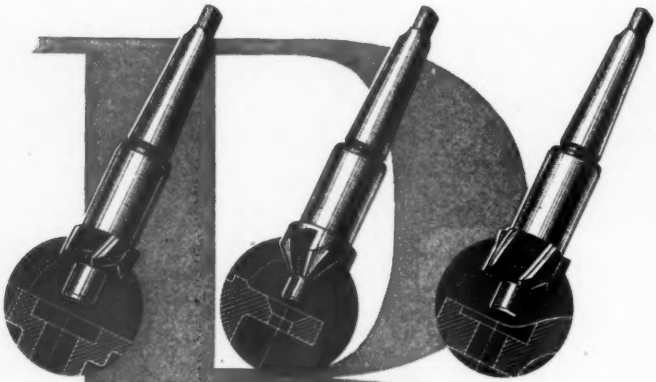
CHICAGO WHEEL & MFG. CO.
1101 W. Monroe Street Dept. TD Chicago 7, Ill.

TD-5

Send Catalog and Survey Form. Interested in ☐ Grinding Wheels ☐ Mounted Wheels ☐ Send Test Wheel Size_____.

NAME_____

ADDRESS_____



PRESCRIPTION FOR THE TOOL ROOM:

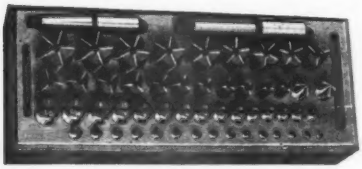
Gairing Interchangeable Counterbore Sets

In tool rooms, machine, die and repair shops, Gairing **Interchangeable** Counterbore Sets provide the proper prescription for all counterboring, countersinking and spot-facing operations. They are adaptable, dependable friends, good medicine neatly boxed in sturdy wooden cases with stout hinged covers.

There are seven sets from which to choose Set C-13 is illustrated here. Each contains a logical assortment of **interchangeable** counterbores, countersinks, [illegible] every set is designed with special features to meet a wide variety of requirements.

The **interchangeable** holders in these sets are of Morse taper or straight shank type (optional). Threaded shank pilots are of selected alloy steel hardened and ground on the head. Shanks are drawn and treated to obtain unusual toughness and strength. High speed steel counterbores are renewable. All counterbores, pilots and holders selected are standard items of the most active sizes used. Replacements may be quickly obtained from stock.

The use of these interchangeable assemblies assures large savings over the old-fashioned solid integral pilot type.



Gairing Interchangeable Counterbore Set No. C-13, that provides two hundred and eighty-one various combinations of pilots and cutters, interchangeable in two holders for counterboring and spot-facing holes from $\frac{3}{8}$" to $1\frac{1}{8}$" inclusive. Counterbore sizes range from $\frac{7}{16}$" to $1\frac{3}{4}$". **Six other sets are available with smaller and larger tools.**

GAIRING
FOR OVER A QUARTER CENTURY
SPECIALISTS IN FINE CUTTING TOOLS

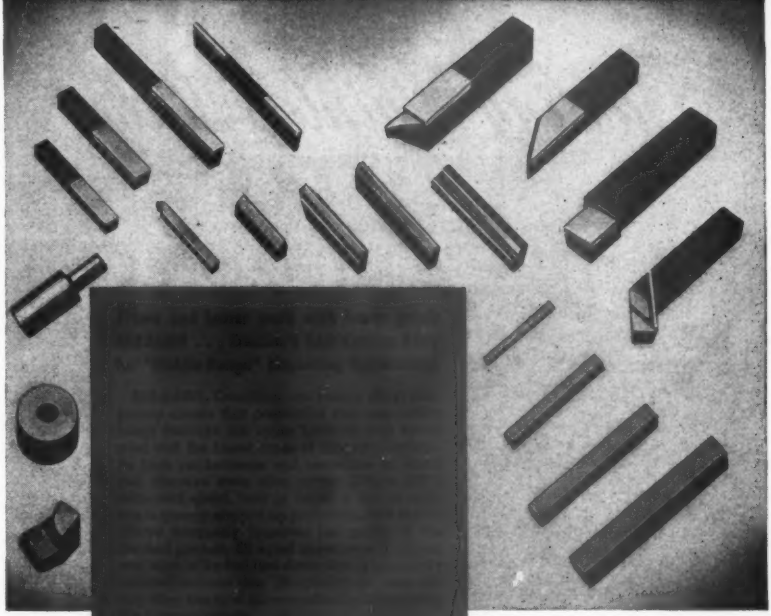
Write us today for our four-page Counterbore Bulletin illustrating, describing and pricing all seven sets.

THE GAIRING TOOL COMPANY, Detroit 32, Michigan

Manufacturers of Standard, Special and Gair-Lock Inserted Blade Cutting Tools

REXALLOY

STANDARD TOOL BITS • STANDARD TIPPED TOOLS • SPECIAL TOOLS-TIPPED AND SOLID • CASTINGS



Crucible Steel Co. of America
405 Lexington Ave., N. Y. 17, N. Y.

☐ Please mail me your new book, "REXALLOY CUTTING TOOLS".

☐ We would like to discuss the possible use of REXALLOY in our plant.

Name _____

Firm _____

Address _____

City _____

CRUCIBLE STEEL COMPANY of America

"FULL-RANGE" QUALITY STEELS — INDUSTRY

"Sterling" Stainless Steels

FOR DISCRIMINATING USERS

A complete line of wire, rod and bars

FIRTH-STERLING—a mill with a national reputation for consistently high quality Tool and Alloy Steels—is in a unique position to meet the special requirements of discriminating users of Stainless Steels. Since 1913, when FIRTH-STERLING made the first Stainless Steel produced in this country, we have specialized on made-to-order types for the most exacting specifications. Literature is available, giving complete details.

"Sterling" Stainless Steels Meet Special Requirements such as:

1. Closely Controlled Compositions.
2. Exacting Physical Requirements.
3. Surface Perfection in Various Finishes.
4. Precise Size and Shape Tolerances.

Ask For:

Bulletin No. SL-2009 on Types 420, 440-A, 440-B, and 440-C.

Bulletin No. SL-2010 on Types 403, 410, and 416.

Bulletin No. SL-2011 on Types 302, 303, and 304.

Bulletin No. SL-2018 on Cold Finished Stainless Steels.

Makers of Fine Stainless Steels Since 1913

Firth-Sterling
STEEL COMPANY

Offices: McKeesport, Pa. New York - Hartford - Philadelphia - Cleveland - Dayton - Detroit - Chicago - Los Angeles

Welch

OIL-HOLE DRILLS

The Welch method of manufacture provides LARGER OIL HOLES, keeping the work cool and permitting FASTER and SMOOTHER drilling.

All sizes, from 7/8 inch to 6½ inches in diameter, and up to 54 inches in length.

PRICES UPON APPLICATION

WELCH INDUSTRIES, INCORPORATED
20,000 WEST 8 MILE ROAD
DETROIT 19, MICHIGAN

WE MANUFACTURE ALL TYPES OF CUTTING TOOLS

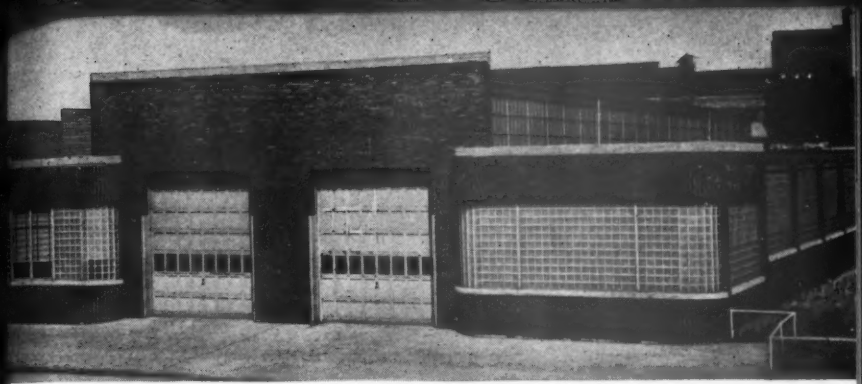
HAS WHAT IT TAKES TO DO YOUR JOB RIGHT . . . at the right price

During the stress of placing urgent war contracts some factors could not always have the same consideration that they would have under normal conditions. Not so with precision tooling and machining. Closer and closer tolerances have made it imperative that precision work be given to those shops which have both the background of experience—years of highly developed skill, and adequate equipment—for utilization of this skill to the best advantage.

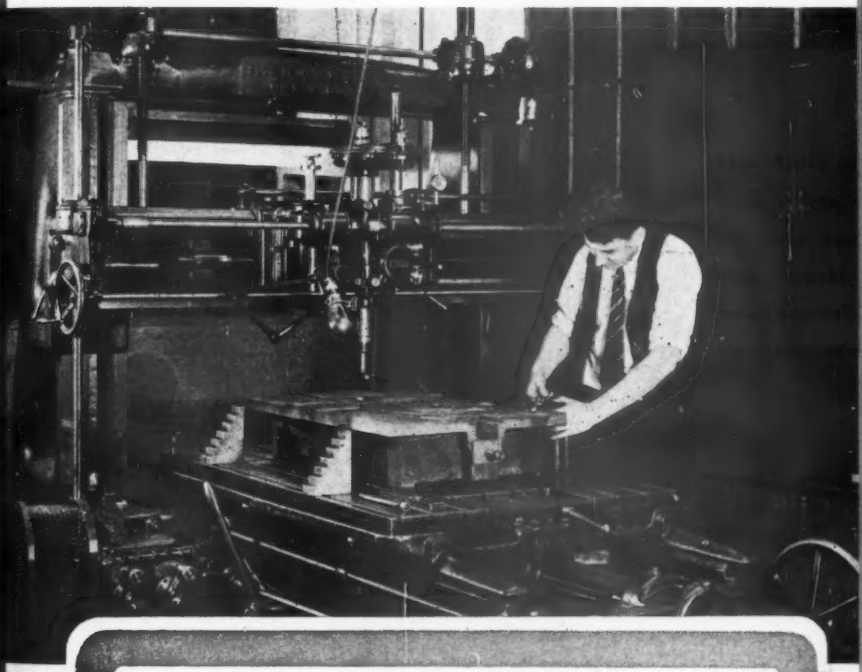
With the Bunell organization fine precision workmanship has been a matter of pride. We invite you to send us drawings, blueprints and specifications of tools and precision parts you require.

THE BUNELL MACHINE & TOOL COMPANY

1601 EAST 23RD STREET • TELEPHONE CHERRY 0343 • CLEVELAND 14, OHIO



Chamber of Commerce award as the best small industrial plant completed in 1941-42.



DESIGNERS AND MANUFACTURERS OF

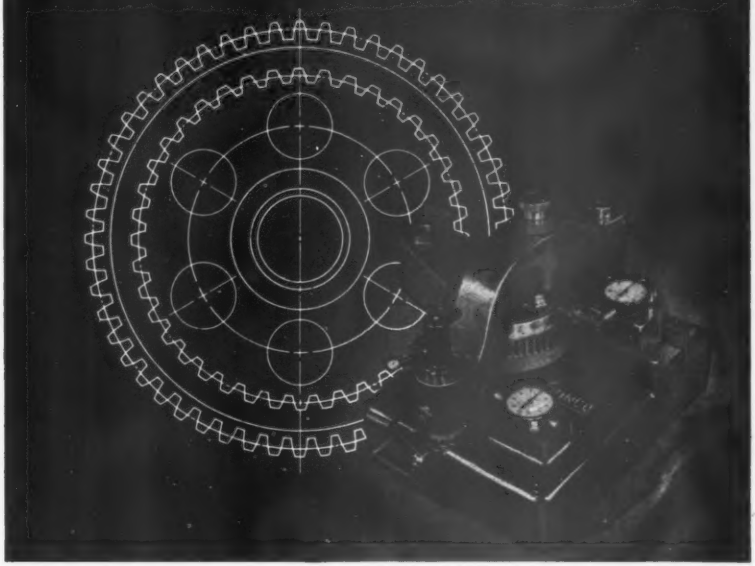
Tools • Special Machinery • Dies • Jigs • Gauges • Fixtures

PRECISION PRODUCTION OF PARTS AND ASSEMBLIES

Radiform

W. F. MEYERS COMPANY, Inc. • Established 1888

A ~~CHAIN~~ *Gear* IS ONLY AS STRONG AS ITS WEAKEST ~~LINK~~ *tooth*



Appropriate apologies for paraphrasing an old proverb! But isn't it the truth?

There is no provision today for error. There is too much at stake. Highly mechanized warfare staged against a bitter, ruthless enemy demands a constant flow of war machines, flawless in construction and exact in every detail. Gears furnish the vital motive power for these engines of destruction—gears decide whether we can out-shoot, out-fly or out-maneuver the enemy. That is the gear maker's responsibility.

VINCO also has a responsibility: to provide speedy, accurate methods of checking the various phases of gear production. VINCO GEAR ROLLING FIXTURES, VINCO MASTER GEARS and the VINCO INVOLUTE CHECKER are doing a masterful job in helping to maintain peak gear production.

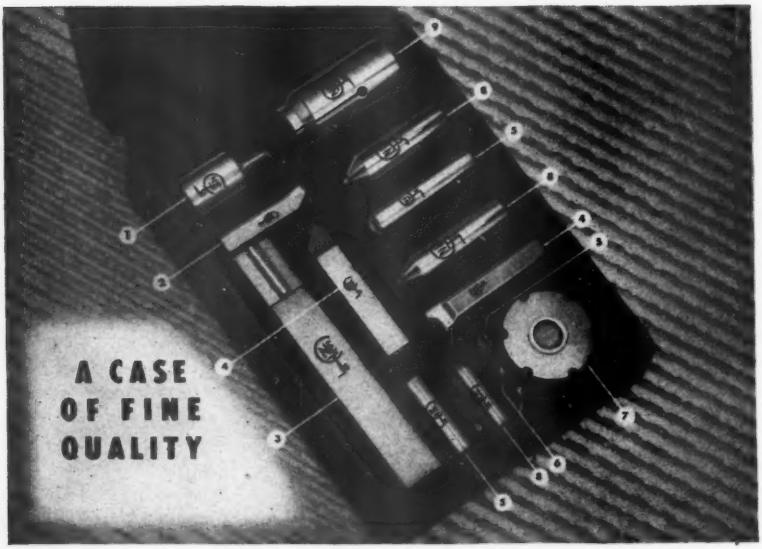
The above insert is a Vinco Gear Rolling Fixture designed to check backlash and run-out on an internal gear—one of hundreds of specially designed gear rolling fixtures that are proving invaluable aids to leading manufacturers in maintaining a high production of precision gears.

VINCO CORPORATION
8871 SCHAEFER HIGHWAY - - DETROIT 27, MICHIGAN

SALES OFFICES
NEW YORK and CHICAGO

MILLIONTHS OF AN INCH FOR SALE BY VINCO

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Circulation and Filtration Units • Engineering, Design and Development



1. Special Carbide or Diamond Boring Tools. **2.** Shaped Diamonds for Jones & Lamson Thread Grinders. **3.** Special Carbide Tipped Tools. **4.** Special Carbide or Diamond Tipped Boring Tools. **5.** Tungsten Carbide, Boron Carbide and Diamond Gage Contact Points. **6.** Diamond Phonopoints for Tap Grinders. **7.** Solid Carbide Burnishing Nests. **8.** Octahedron Diamonds in either Jones & Lamson or Excello Holders. **9.** Collets and Bushings with Carbide Inserts.

NE

Quality is the case in point—exemplified by the line of tungsten carbide, boron carbide, and diamond tipped tools shown above. These New England Carbide products represent a wide range of tools and parts to cover your standard or special requirements.

When you think of precision production, think of precision New England tools and parts, because every one is checked and double checked to specified tolerances. *If it can be tipped, New England can do it—exactly!*

Mail the coupon today for complete information on the New England precision line.

Without obligation, please send me further information on the items checked below.

1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐ 8☐ 9☐

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

TDJ-5

60 BROOKLINE ST., CAMBRIDGE 39, MASS.

SPECIFY Precision LATHE ATTACHMENTS

IMMEDIATE DELIVERY FROM STOCK

For 10" Atlas & Logan, 9" South Bend ½" Capacity Lathes, etc.

LEVER TYPE CROSS-SLIDE List $45.00

LEVER TYPE DRAWBAR List $38.95

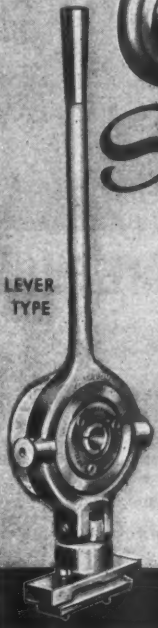
Order from your dealer or write us for literature.

HAND TYPE BREN Collet $4.50 ea.

SpeediChuk

WITH THE Precision BREN COLLET

HAND DRAWBAR $18.50



LEVER TYPE

- Increases ½" collet capacity lathes to ¾".
- Ready for instant use and interchangeable on any 1½" x 8 thread spindle lathe . . . . Atlas, Logan, 9" South Bend, Clausing, etc.
- Full Spindle Accuracy.
- LEVER TYPE for continuous production. Feather pressure releases work while lathe is running. LIST $79.50, Collet extra.
- HAND TYPE for use where quantity production is not required. Lathe must be stopped to open and close collet. LIST $19.75, Collet extra.

GENERAL DIE-STAMPING-TOOL COMPANY

PRECISION COLLET DIVISION 265 Canal Street, New York 13, N.Y.

HOLO-KROME

Trade **FIBRO FORGED** Mark **SOCKET SCREWS**

THE *BETTER* FASTENING METHOD

Completely Cold Forged

Method patented, owned, controlled and used exclusively by HOLO-KROME in the manufacture of Holo-Krome FIBRO FORGED Socket Screws

GUARANTEED UNFAILING PERFORMANCE

THE **HOLO-KROME** SCREW CORP. — SOCKET SCREW PRODUCTS — HARTFORD 10, CONN. U. S. A.

THE TOOL & DIE JOURNAL

GEORGE J. HUEBNER • EDITOR, PUBLISHER

Technical Editor, E. WILLARD PENNINGTON — Assistant Editor, PAUL L. REED

Contents

Vol. X, No. 2 — May, 1944

Editorial	George J. Huebner	85
Emergency Repair of Screw Machine Collets by Welding and Grinding	Albert W. Ehlers	87
Accuracy and the Geometry of Precision, Part IV	E. Willard Pennington	90
Developments in Precision Tapping	R. R. Williams	93
Materials Weight Tables	Geo. H. Thompson	94
Industrial Plastics		
Thermoplastic Materials	Warren V. Prince	98-C
Glass Reinforced Laminates for Structural Plane Parts		98-L
Duralon		98-P
Drilling and Tapping Plastics Materials		99
Contour Cavity Forging of Large Caliber Shell	John C. Norman	102
Modern Designs for Drilling Jigs and Tapping Fixtures	C. W. Hinman	106
Progress on Parade		111
Industrial Digest		120
Supplementary Index		125
Publication Previews		131
Shop Aids		149
Index to Advertisers		225

The Tool & Die Journal is published monthly for those industry key men who are responsible for designing, building and using precision tooling

Controlled Circulation — CBI Coverage • Official Publication: Tool & Die Institute

PUBLICATION OFFICE

CATHRYN H. EVANS, Business Manager — MARY D. VECCIA, Production Manager

2460 Fairmount Boulevard, Cleveland 6, Ohio

REGIONAL ADVERTISING OFFICES

Detroit 2.....R. F. Pickrell, 314 Stephenson Bldg.....TRinity 1-0780
Chicago 2.....L. B. Hammond, 123 W. Madison St.....RANdolph 1843
New York 17.....H. Thayer Heaton, 415 Lexington Ave.....MUrray Hill 2-1647
Cleveland 15.....L. D. Orner, 801 Caxton Bldg.....MAin 8719
New England....R. J. Weeks, 420 Lexington Ave., New York 17....MUrray Hill 4-7752
California.....M. D. Pugh, 2989 Lincoln Ave., Altadena.....SYcamore 7-2894

Copyright 1944 by Geo. J. Huebner

Acceptance under the Act of June 5, 1934, authorized October 22, 1942

EVEN as you—and all of the rest of us—have contributed men to the Armed Services, so has your Industrial Supply Distributor.◊

Most of these ISD men had sound training before they ever put on the Uniform. They were trained to locate supplies of scarce or critical materials for your plant—trained in getting them to you on schedule—trained in anticipating your requirements.

Now in the various technical branches of the Services, these men are learning a great deal. They will bring back new experiences, new skills and new ideas from which you are sure to benefit. Today, new men are in the making—for you.

Meanwhile, please continue to call upon your Distributor for all of the things you need instead of ordering direct from the factory. The older and more experienced men are still there—you will simplify the manufacturer's job—and will help to ease the carriers' loads as well.

Get this good habit and ***keep*** it—

Telephone your ◊◊◊ FIRST!

ARMY NAVY ARMY E NAVY

The CLEVELAND TWISTDRILL COMPANY
1242 EAST 49TH STREET
CLEVELAND

30 RECTOR ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 616 HOWARD ST. SAN FRANCISCO
1501 BEAUBIEN BLVD. DETROIT · LONDON · E. P. BARRUS, LTD. · 31-33 UPPER THAMES ST. E.C.4

"CLEVELAND DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU"

TRANSPORTATION AND PROSPERITY

"A NATION on Wheels—"

Before the outbreak of war this phrase aptly characterized a national habit. It was in reality a tribute to the automobile and to the automotive industry.

The automobile builders have written a dramatic chapter in American industrial history. This single industry was responsible for profound changes in our industrial and economic structure. Its new standards of production efficiency influenced the precision of all manufacture; it stimulated new developments in steel and other basic materials. The automotive industry inaugurated new liberal labor policies and working conditions. It demonstrated in practice the theory that a mass production industry which operated with a small unit profit on a large production and wide distribution basis was a sounder contribution to the American way of life than an industry which operated on the policy of a big profit on a small or limited output.

The development of our automotive industry has made its influence felt in many places abroad. Still, a full realization of its overwhelming power has come to many only when, as allies, they were aided and inspired by the surging production of American planes, tanks, guns and shell; or, as enemies, they were set back by the shock of its collective strength.

For centuries the destinies of nations have been influenced, even decided, by methods and means of transportation. Slave galleys carried the Roman legions to distant Mediterranean ports, extending the Empire's dominions, and, returning with products of commerce, developed its trade. Venice, Spain and Britain in turn rose to world power on the guns and sails of their fleets. Our expansion in world trade began when our shipyards gave us *Flying Clouds* to carry cargoes in record time back and forth across the seas.

The development of steam as a motive power opened an era of tremendous industrial activity. The railways spanned the continent, encouraged the building of cities and their industrial development, bringing a new closer sense of national solidarity. All this brought a scale of prosperity undreamed of before.

Right now we are witnessing the most spectacular of all

developments in transportation—the expansion of transport by air. Aside from strictly fighting ships the most amazing revolution in transportation is undoubtedly the giant long-range cargo planes. Their possibilities excite the imagination.

Postwar airliners and de luxe streamlined trains will vie with each other for passenger traffic. Airlines and railways will compete for freight business. Both will have to compete with the automobile. The American likes his car and he likes that way of going places and seeing things.

The air transport manufacturers have new substratosphere passenger and cargo planes (on drafting boards, thoughtfully tucked away) and the railways—for the first time in years—have surplus earnings. A large proportion of modern rail equipment is not available for non-military use and the manpower situation prevents many improvements to fixed properties.

In contrast, the automobile manufacturers, relieved of war production, will be turning out cars while the railways are still busy transporting troops home. However, railroad freight revenues should continue as steel, rubber, coal and oil flow into the automobile plants for peacetime production.

Research, development, model making and tooling, new materials and processes—all will contribute a share to reconversion and postwar prosperity. The automobile industry will continue to move in the vanguard of industrial progress. Consistently it has been among the first of the larger industries to discard the obsolete and to adopt modern and more efficient methods and equipment. For example, General Motors only recently informed a group of machine tool builders that it has $500,000,000 to spend for reconversion and postwar equipment. At the same time officials of the motor company warned the tool builders that there were both some machines and machining methods that could be greatly improved.

After Pearl Harbor representatives of the great automotive organizations, the parts manufacturers and the tool and die suppliers organized the Automotive Council for War Production. This cooperative effort, soundly based on a long prewar association, became a tremendously important factor in the production of allied war materiel. When the war ends, this industrial initiative can turn quickly to peacetime products. With automotive manufacturers, railway managements and airline operators aware of what travel-minded Americans like, and aware of premium cargo and fast freight possibilities, it is clear that our industries which build and operate transportation equipment, both private and public, can, along with their suppliers, assume the historic initiative of the transportation industries.

Editor

EMERGENCY REPAIR OF SCREW MACHINE COLLETS BY WELDING AND GRINDING

Albert W. Ehlers
TOOL SUPERINTENDENT
McQuay - Norris Mfg. Co.

In its attempt to supply collets for continuous production on automatic screw machines or turret lathes in either first or second operation machinery, the Tool Control Department may be faced with delayed deliveries from vendors or with an error in forecasting machine requirements. This results in the inevitable "down-time" report when wartime production dictates continuous operation.

The provision of one set of collets for a specific stock size is the usual case on short run jobs. When one of these collets breaks or becomes sprung and a replacement is not available, the operation on an odd number of spindles is sometimes permitted when tooling can be "double-decked". However, in many cases this cannot be accomplished and the machine is down until collets can be procured.

I have been faced with this situation on many occasions and in desperation I have attempted many an unorthodox attempt at salvage. Many attempts failed, but a standard procedure was finally developed which has proven successful.

Broken or sprung screw machine collets are usually the result of chucking too tight or allowing the collet to become unscrewed from a collet fit and become sloppy. This is an expected casualty when new operators are placed in the production line fresh from the training school.

In my experience, I find that an automatic screw machine collet of 120 degrees, three split construction, will either break at the end of a split section adjacent to the collar or will break back of the collar in the threaded portion which will snap off in rather a clean break.

In reviewing the first instance, an entire 120 degree segment will break away from the collet proper. Welding or brazing seemed to be the only answer to the salvage problem. At first, low temperature eutectic alloys, tobin bronze and even silver solders were attempted, but the welded or brazed joint developed a permanent set at the first chucking.

Arc-welding was next attempted with careful attention paid to pre-heating the weld area. Plain steel and alloy steel coated rods were used, but the collets were not successfully repaired because the adjacent parent metal became embrittled due to the extreme heat of the arc. Subsequent attempts at tempering through various stages did not improve the situation.

A recourse to oxygen-acetylene welding, and the help of an old welder's blacksmithing memories finally solved the problem and a sound welded collet was produced that performed successfully. No attempt is being made to prove that the welded collet will supplant the need for new replacement collets, but simply that this outlined method of salvage will pull through an emergency when the Planning Department is howling down your neck. Many a welded collet is still performing with the balance of the unbroken members of the set in everyday production.

The first operation in welding the broken collet is to prepare the broken ends. If the break is fairly uniform, regular 45 degree chamfers should extend from the OD to the ID surfaces. If the break is irregular, permitting a "jig-saw puzzle" fit, the edges may be prepared with a small, mounted point-wheel in an air motor hand grinder.

In order to provide a "jig" for all

size collet ID's, a damp clay core is used which is rammed into the collet ID from the rear. The clay may be supplanted by green core sand and binder. After this core has become semi-set, the broken segment is wired securely to the collet proper. The clay or sand core supports the segment to be welded, and aside from assisting in holding the piece in alignment, it holds heat and prevents filler metal from falling through to the ID of the collet. Ground steel wedges are inserted between the three expansion slits. These assist in alignment and also prevent the segments from contracting when the welding heat is applied.

The face of the collet should be carefully aligned by placing the face against a surface or angle plate and readjusting tension on the wire. This is particularly important because a short or long segment will result in uneven pressure over the tapered section when it locks the bar stock in the automatic. Uneven pressure will break an otherwise perfectly welded job.

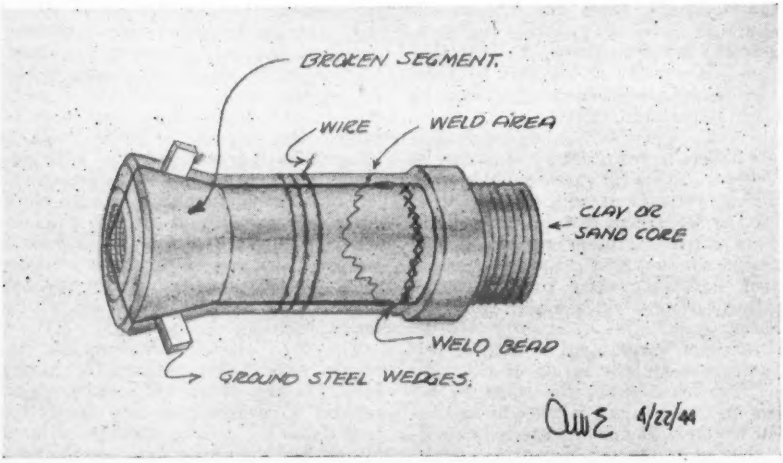
The smallest welding tip for the torch should be selected comparable with good welding practice and the size and thickness of the collet to be welded. The rod selected should be standard ⅛" mild steel filler rod.

After tack welds are placed on the ends and the middle of the joint the alignment may be readjusted. The rod is then carefully puddled into the vee section to form a tight, flat bead. After the weld is completed, allow the collet to cool slowly to hand heat in sand, mica or lime.

The next step is to draw the collet at approximately 450° F in a furnace for one hour to remove welding strain. Remove and let cool to hand heat in air. The clay or sand core should next be driven out, the wedges re-inserted and the collet re-wired to place tension against the wedges. Grind off any excess weld metal on the OD by careful hand grinding on a tool and cutter grinder between centers. If some weld spelter has penetrated to the ID, clean it up with an internal grinding attachment or by hand filing with rat-tail file.

Reheat the weld area slowly with neutral flame torch to a dark cherry red. Quickly quench in oil and draw the collet at 600° F for one hour. Remove the collet from the draw and let it cool to hand heat in air.

The next step is to use the old black-



A broken collet "tooled-up" for emergency repair. After chamfering the edges of the break, the broken segment is supported and held in correct position by the steel wedges, ID core and retaining wire, preliminary to following Mr. Ehler's unique welding and heat treating procedure.

smithing technique for final tempering. Polish the weld area with emery cloth to a bright finish so that tempering colors may be observed. Fan the welding flame slowly across the weld area. The colors will progress through light and dark straw to the purples and finally to a dark blue. Quickly quench in oil and then remove any scale on ID and OD with a wire spoke brush.

Still using the blacksmithing technique, successively strike the sections of the collet with a hammer and notice the similarity in "ring" or pitch. Such a collet is sound; put it into your automatic and forget it.

In the second case where the collet is broken in the threaded portion, the operations are essentially the same but with the following exceptions: Before tack welding, the sections should be carefully aligned with an ID plug of bar stock used in the same manner as a plug gage. After tack welding, the clay or sand core may be inserted. After welding and after the first draw, set the collet up between centers on a tool and cutter grinder and remove the band of weld metal in adjacent threads by grinding below the pitch diameter of the threads. This narrow band to be ground is usually ¼" wide if the welding has been closely controlled.

If the collet segments have become sprung, the sections can be aligned by using the welding torch, a vise and a pipe wrench. The drawing and tempering steps should be followed as indicated in the case of the broken collets.

Every screw machine or turret lathe operator is acquainted with the grinding out of collets to a larger size using a Dumore type tool post grinder. This, however, takes quite a bit of time and during the operation the machine is out of production and planning has been affected.

Collets can be returned to the vendor for this reworking and if enough time is available this is the practical method. However, in an emergency an entire set of collets may be reground to the desired ID size on a tool and cutter grinder without loss of production time.

For an example, a set of standard 1¼" collets are to be reground for 1.262" round, special stock. The first step is to collapse the three segments of the 120 degree split collet around a piece of 1¼" stock. A regular three jaw universal chuck is used so that each jaw forces in a corresponding collet segment. The collapsed collet is then securely wired to hold the tension after its removal from the chuck. Drive out the bar stock plug and place the threaded end in the chuck of the cylindrical grinding attachment on a tool and cutter grinder. Align with dial indicator and remove the excess stock with internal grinding attachment.

A set of collets reground in this manner will usually show a run out of .002" in the ID, but they will run true enough for the average first or second operation.

Another salvage operation may be performed on collets and pushers when the ID has become too worn to hold the bar stock. The usual condition is that the three segments of the collet cannot collapse enough to compensate for ID wear because the split section gap is not wide enough. This may be corrected in an emergency by setting the collet or pusher in the universal vise of a tool and cutter grinder and enlarging the gap by using a rubber or synthetic bonded cut-off wheel. Care must be used to remove the same amount of stock in each segment gap and in each collet of the set. This may be accomplished by correct vertical alignment of slot in the vise and the use of the horizontal table adjustments on the grinder.

The writer earnestly solicits the reader's consideration of the details as explained. I can say from experience that a competent welder with a steady hand and a little practice can salvage collets in much less time than seems indicated.

My metallurgical laboratory friends cannot subscribe to the rather unorthodox drawing and tempering technique as developed; especially the preliminary draw to remove welding strains at 450° F. However, the average shop man does not care if eutectic, pearlitic or martensitic structures are being exploited—he is interested in results. This heat treatment works. Try it for yourself.

PLASTICS MOLDS
Design . Construction . Use
New second edition just off the press! The standard authority on its subject. See display ad Page 125.
by Gordon B. Thayer

ACCURACY AND THE GEOMETRY OF PRECISION Part IV*

E. Willard Pennington
TECHNICAL EDITOR

In the previous article of this series (Tool & Die Journal, February, 1944) the methods were outlined for producing true and self-proving 90° master angles for inspection and shop reference purposes. Angles other than 90° can be generated or originated by the scraping process and in this concluding chapter of our series on flat surfaces, straight edges and angles we cover the all-important angles of 30°, 45° and 60°.

It will be recalled that it was shown that the precise work of generating truly flat surfaces was not only self-proving but that the attainment of final perfection did not in any way depend (for geometrical accuracy) on any work that had gone before. The method employed, i.e., the successive reduction and elimination of demonstrable errors in three geometrically symmetrical objects by scraping, was, itself, the automatic and conclusive "tell-tale" that indicated when the work had reached the ultimate state of perfection.

The methods of generating 30°, 45° and 60° angles are likewise self-proving by virtue of following the same procedure of reducing errors to the vanishing point. The similarity to the previously described flat surface technique ends there however, because, in the case of producing these lesser angles (less than the 180° of a plane surface), we are dependent upon work previously done to the extent that we need, for our set-up, truly flat surfaces, straight edges and 90° angles.

For the origination of angles of 45° we must have a true right angle as one angle of a triangle in which the desired 45° angles are the other two. The set-up is made as is shown in Fig. 1. The triangle ABC which is to contain the two master 45° angles is placed on a surface plate. By the previously described generating methods or by checking against a master square, angle C must have been made to equal a true 90°. The two straight edges are next placed on the surface plate and positioned to fit one of the assumed (at this stage of the game) 45° angles. The triangle is then removed without disturbing the straight edges, and it is replaced with its angle B in the included angle between the two straight edges. Knowing that angle C is a true 90°, if this test shows that angles A and B are equal, they are, of necessity, 45° each. $A = B = 45°$, therefore, $45° + 45° + 90° = 180°$, the sum of the angles of a triangle. If this test shows that A and B are unequal, correction is made by scraping only the hypotenuse of the triangle and, of course, the test indicates the direction in which the scraping must be done, i.e., the hypotenuse must be adjusted either clockwise or counter-

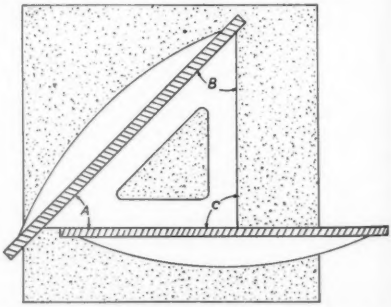


Fig. 1—Set-up for proving the 45° angles of triangle ABC. Two straight edges positioned on surface plate so as to fit one of the 45° angles (A) under test. Angle C must previously have been made a true 90°.

*Part I, Tool & Die Journal, November 1943, page 90. Part II, Tool & Die Journal, January 1944, page 22. Part III, Tool & Die Journal, February 1944, page 102.

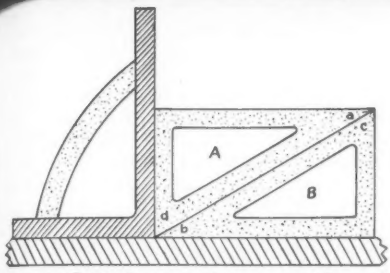


Fig. 2—Initial set-up for correcting and proving 30° and 60° angles.

clockwise. After the initial correction by scraping, a second test is made in the same manner as the first with the straight edges readjusted to conform to angle A. Repositioning angle B within the included angle of the straight edges will show to what extent correction (or over correction) has been attained. The scraping of the hypotenuse and inspection is repeated until A becomes equal to B when we have a master triangle of true 90° and 45° angles, generated by scraping to the point of self-proof.

Master angles of 30° and 60° are produced in the form of 30° and 60° triangles and are originated or generated in sets of three. This procedure requires a master surface plate or straight edge and a master square. Three triangles, A, B and C, must each have two sides at a true 90° angle. This means that the hypotenuse and the 30° and 60° angles are in doubt and are to be corrected. Fig. 2 shows the preliminary set-up for correcting 30° and 60° angles. Two of the triangles, A and B, are positioned to occupy the 90° included angle formed between the master square and the surface plate or straight edge. Scraping is applied to the hypotenuse of each triangle until the right angle between the square and surface plate is completely filled. Bearing in mind that the true 90° angles of the triangles have not been disturbed, the top and bottom lines formed by the two triangles are truly parallel and are "cut" by a diagonal (the hypotenuse common to the two triangles). Therefore angles $a = b$ and angles $c = d$; and furthermore, angles a and c are complementary and angles b and d are complementary, i.e., $a + c = 90°$ and $b + d = 90°$. Note, however, that there is no assurance that angles a and b are each truly 30° or that angles c and d are each truly 60°, and without any proof that they are correct there is every likelihood that they are wrong! The next step is that of substituting triangle C for triangle A and of scraping the hypotenuse of C until triangle C and B fill the 90° angle between the surface plate and master square as did triangles A and B. Note here that no scraping is to be done on triangle B as the object is to produce three equal triangles—equal as to degree of error. After the hypotenuse of triangle C has been scraped, we know that the three smaller angles, a, b, and e, are equal to each other although we have no proof as to their mutual departure from a true 30°.

The next step, and first attempt at proof, is shown in Fig. 4. This grouping of the triangles A, B and C shows the error that exists insofar as angles a, e and b each equaling 30°. When correct, angles $a + e + b = 90°$, therefore the amount by which the three triangles exceed, or fail to fill, the 90° angle between the straight edge and master square, is the *total* error existing in angles a, e and b; and inasmuch as angles a, e and b have previously been made equal, the error in each is equal to one-third of the total demonstrated by the set-up of Fig. 4. Knowing the amount of the error, and its direction, scraping is performed on the hypotenuse of each triangle, and as nearly equally on each as possible, until the 90° test angle of Fig. 4 is accurately filled. It is too much to expect that this scraping

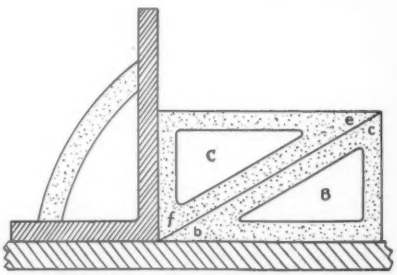


Fig. 3—With the hypotenuse of triangle C scraped to fulfill the conditions specified for triangles A and B, angles e and b are equal, angles f and c are equal, and angles e and c and angles f and b are complementary.

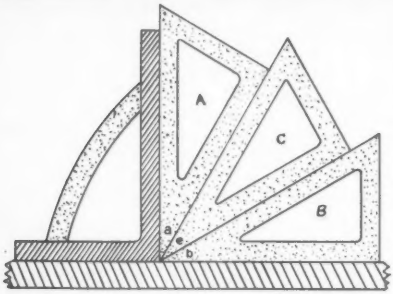


Fig. 4 — This grouping of the three triangles, following the procedures of Fig. 2 and Fig. 3, shows either that angles a, e and b are each 30° or that they are of a uniform plus or minus error.

procedure will not upset the equality of the angles, but at least the individual and total errors should be appreciably lessened. Therefore, the steps first described and illustrated in Figs. 2 and 3 should be repeated after which a repeat of the test outlined in Fig. 4 should show a much smaller total error and closer approach to perfection. Final perfection is attained by these repetitive scraping procedures until the tests of Figs. 2, 3 and 4, made with all three triangles and/or any two out of the three, show no possible improvement, hence perfection.

From the foregoing we know that we have three triangles of which each one has two known and provable angles of 90° and 30°. Therefore the remaining angle of each triangle must be 60°. For those from Missouri, the independent test illustrated in Fig. 5 should serve to satisfy beyond all doubt that $60° + 60° + 60° = 180°$!

So far we have spoken of, and accepted, scraping as a rather matter-of-fact, garden-variety procedure. Actually, scraping is a craft, almost an art, of high personal skill and worthy of mastering by any mechanic if for no other reason than for the appreciation that it engenders of the accuracy that can be attained in no other way. Metal working by scraping is the extremely localized removal of metal through the coordination of the skilled worker's eye and the control he exercises over a hand operated tool. The object of scraping is to either reduce an irregular surface to a flat surface or to bring two or more surfaces into intimate and uniform contact. In all cases this is accomplished by so scraping the irregularly high spots that they become uniform as to height and area. The admitted tediousness of scraping can only be offset by the satisfaction and pride that comes from the performance of a difficult job to the highest degree of accuracy.

One of our leading machine tool builders advises that if a man possesses an average amount of mechanical ability, along with the willingness to learn, he should know the fundamentals involved in scraping in about three months. The time required to train a man will increase depending on the variety of scraping he is expected to do. It is noted that a younger man does not adapt himself as readily to the tediousness of scraping as does a man of about thirty.

Finished scraped surfaces are examined for a small dense and uniform bearing, free from scratches and scraper marks, resulting in a spotting job sufficiently good to insure a long wearing surface. Although there are no strict rules specifying the number of high spots per inch, the size of the average spot should be approximately $\frac{1}{16}$" square and their total area should cover about $\frac{2}{3}$ of a square inch.

Some of the mistakes most common to beginners are:

(a) They do not properly sharpen their scrapers.

(b) They do not analyze the job's requirements.

(c) They do not alternate their direction of working but scrape in the direction which is easiest.

With many "professional" scrapermen, carbide tipped scrapers are used almost exclusively.

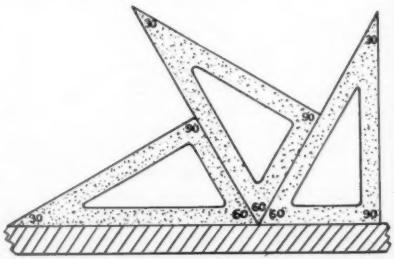


Fig. 5 — The test set-up for those from Missouri!

DEVELOPMENTS IN PRECISION TAPPING

by R. R Williams

Thread Engineer

From the time U. S. industry started the widespread production of aircraft engines thread cutting problems were encountered, due to material and precision requirements, that were entirely new to peacetime production.

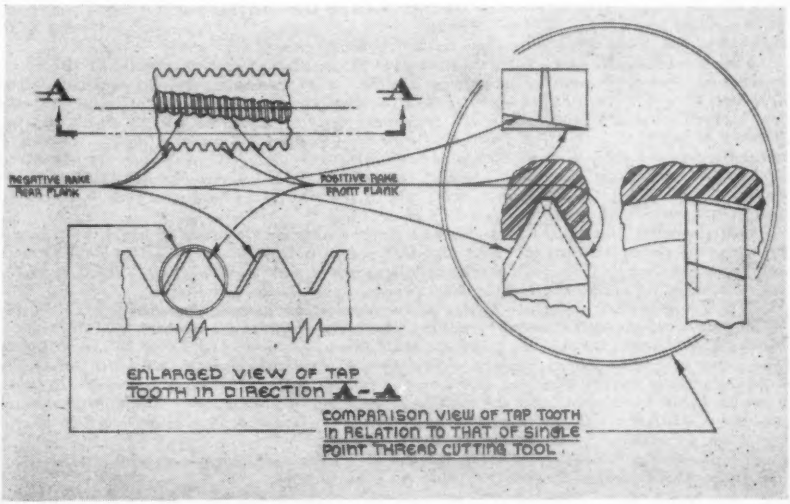
Tap manufacturers were in little better position than tap users as these were entirely new problems and the entire industry was clamoring for taps, giving the tap manufacturer no time for experimentation. Some of us, however, were fortunate in having the necessary equipment for making taps and gages. Thus we were able to not only make taps to cover what we could not procure soon enough, but also were able to do some experimental work. From these experiments I have drawn some notes that may be helpful to others.

Spiral Taps for Blind Hole Tapping

Right hand spiral taps are often specified when the clearance between the bottom of a hole and the last thread is not sufficient to give necessary chip clearance; hence the chips are trapped beneath the tap thus preventing it from going full depth. Evidence of this condition includes torn threads at the bottom of the hole, inability to maintain depth, over-size holes and broken taps.

A right hand spiral tap is supposed, however, to lift the chips away from the bottom of the hole. The value of the spiral flute in this respect is far outweighed by the fact that the tap cannot be expected to cut a thread smooth on both flanks as the one flank will be cut by the side of the tooth having a positive rake, and the other flank by the negative rake side of the tooth.

Let us take as an example a 15° right hand spiral tap. Consider one tooth of



that tap and visualize it as a single-point threading tool in a lathe. We would then have the condition as shown in the accompanying drawing.

A thread cut with a single-point tool with the rake angle as shown also could not be expected to be smooth on both flanks. The positive rake or shear cutting side of the tool would cut smooth whereas the side of the tool with the negative rake would leave a rough or torn surface. This same condition would prevail in the case of the tap under consideration.

This is not conjecture or theory alone; a number of experiments were made and, in every case, that flank of the thread not visible from the top of the hole was rough and torn.

Now, inasmuch as the thread flank that is not visible from the top or entering side of the hole is the flank against which all pressure of the stud or screw is applied, it can readily be seen that this condition is wrong.

We have found that a standard straight flute tap will give the best results in combination with the following method:

Fill the hole with a sulphur base thread oil of about the consistency of 600-W; thus, as the tap enters the hole, the oil will be forced up out of the hole carrying with it most of the chips from under the end of the tap.

MATERIALS WEIGHT TABLES

On the following four pages we present the first installment of a feature that should be of great and lasting value to our readers.

These Materials Weight Tables were calculated and compiled by Geo. H. Thompson, Treasurer, The Cleveland Metal Stamping Company, and have been in practical, everyday use for many years. Designed to reduce to a minimum the work of calculating the total weight of steel (where 1 cu. in.=.2836 lb) required for a given press run, the tables are so basic as to be readily applicable for other materials and purposes.

The use of the tables is simplicity itself. For instance, given a job that is to be blanked out of strip stock 4" wide, with a "pitch" or length of stock feed per blank of $6\frac{15}{16}$", and assume a stock thickness of .032". In the column headed by $6\frac{15}{16}$" we find the constant 7869.90 opposite 4". Multiplying 7869.90 by .032 gives 251.8368 or 252, which is the weight in pounds for one thousand pieces 4" x $6\frac{15}{16}$" x .032". Suppose, however, that the stock requirement was $4\frac{3}{4}$" x $6\frac{15}{16}$". In such a case we refer to the same column headed by $6\frac{15}{16}$" and to the constant given for 4" we add the constant shown for $\frac{3}{4}$", or 7869.90 + 1475.61 = 9345.51. This new constant multiplied by .032 gives 299 lbs as the weight of 1000 pieces, $4\frac{3}{4}$" x $6\frac{15}{16}$" x .032".

These tables will serve for any material by multiplying the weight of the stock in steel by the appropriate conversion factor. For instance, in the example given for steel 4" x $6\frac{15}{16}$" x .032" weighing 252 lbs per thousand pieces, multiplying the steel weight by 1.136 gives the stock requirement for the same job in sheet copper: 252 x 1.136 = 286.272 or 287 lbs for 1000 pieces of copper 4" x $6\frac{15}{16}$" x .032". Likewise, using the same example and the conversion factor of .358 gives a weight requirement of 91 lbs in mica; and the conversion factor of 1.077 gives a weight of 272 lbs for the same job in Monel. Each month we plan to publish supplementary data that will make these tables of greater value as a shop tool.

Additionally, the tables will give the weight of a single piece of stock by moving the decimal point three places to the left. For instance, to find the weight of a block of steel 4" x $6\frac{15}{16}$" x $3\frac{1}{8}$" thick: multiplying the above constant, 7869.0, by 3.125 gives a weight of 24,590.625 lbs for 1000 pieces, or 24.59 lbs per piece.

Mr. Thompson's original tables were carried to eleven decimal places in his initial calculations and involved working the formula, length x width x .2836 = constant, 36,764 times in covering the sizes of from $\frac{1}{16}$" x $\frac{1}{16}$" to 12" x 12" in steps of $\frac{1}{16}$". Our condensed arrangement, however, will permit reproducing the tables on 32 pages which we have scheduled 4 pages per month for 8 months, and we plan to make them available later as a 32-page reprint of the series. Each page carries 6 columns so there will be a total of 192 columns, headed by dimensions in increments of $\frac{1}{16}$", from $\frac{1}{16}$" to 12".

We plan to publish, with each month's installment, supplementary data, that will make these tables of greater value as a shop tool.

E. W. P., Tech. Ed.

MATERIALS[1] WEIGHT[2] TABLES (T&DJ Condensed Arrangement)

Calculated and Compiled by Geo. H. Thompson

	6 1/16" x		6 1/8" x		6 1/16" x		7" x		7 1/16" x		7 1/8" x	
1"	1932.03	1"	1949.75	1"	1967.48	1"	1985.20	1"	2002.93	1"	2020.65
2"	3864.05	2"	3899.50	2"	3934.95	2"	3970.40	2"	4005.85	2"	4041.30
3"	5796.08	3"	5849.25	3"	5902.43	3"	5955.60	3"	6008.78	3"	6061.95
4"	7728.10	4"	7799.00	4"	7869.90	4"	7940.80	4"	8011.70	4"	8082.60
5"	9660.13	5"	9748.75	5"	9837.38	5"	9926.00	5"	10014.60	5"	10103.30
6"	11592.20	6"	11698.50	6"	11804.90	6"	11911.20	6"	12017.60	6"	12123.90
7"	13524.20	7"	13648.30	7"	13772.30	7"	13896.40	7"	14020.50	7"	14144.60
8"	15456.20	8"	15598.00	8"	15739.80	8"	15881.60	8"	16023.40	8"	16165.20
9"	17388.20	9"	17547.80	9"	17707.30	9"	17866.80	9"	18026.30	9"	18185.90
10"	19320.30	10"	19497.50	10"	19674.80	10"	19852.00	10"	20029.30	10"	20206.50
11"	21252.30	11"	21447.30	11"	21642.20	11"	21837.20	11"	22032.20	11"	22227.20
12"	23184.30	12"	23397.00	12"	23609.70	12"	23822.40	12"	24035.10	12"	24247.80
1/16"	120.75	1/16"	121.86	1/16"	122.97	1/16"	124.08	1/16"	125.19	1/16"	126.30
1/8"	241.50	1/8"	243.72	1/8"	245.93	1/8"	248.15	1/8"	250.37	1/8"	252.58
3/16"	362.25	3/16"	365.58	3/16"	368.90	3/16"	372.23	3/16"	375.55	3/16"	378.87
1/4"	483.00	1/4"	487.44	1/4"	491.87	1/4"	496.30	1/4"	500.73	1/4"	505.16
5/16"	603.76	5/16"	609.30	5/16"	614.84	5/16"	620.38	5/16"	625.91	5/16"	631.45
3/8"	724.51	3/8"	731.16	3/8"	737.80	3/8"	744.45	3/8"	751.10	3/8"	757.74
7/16"	845.26	7/16"	853.02	7/16"	860.77	7/16"	868.53	7/16"	876.28	7/16"	884.03
1/2"	966.01	1/2"	974.88	1/2"	983.74	1/2"	992.60	1/2"	1001.46	1/2"	1010.33
9/16"	1086.76	9/16"	1096.73	9/16"	1106.70	9/16"	1116.68	9/16"	1126.65	9/16"	1136.62
5/8"	1207.52	5/8"	1218.59	5/8"	1229.67	5/8"	1240.75	5/8"	1251.83	5/8"	1262.91
11/16"	1328.27	11/16"	1340.45	11/16"	1352.64	11/16"	1364.83	11/16"	1377.01	11/16"	1389.20
3/4"	1449.02	3/4"	1462.31	3/4"	1475.61	3/4"	1488.90	3/4"	1502.19	3/4"	1515.49
13/16"	1569.77	13/16"	1584.17	13/16"	1598.57	13/16"	1612.98	13/16"	1627.38	13/16"	1641.78
7/8"	1690.52	7/8"	1706.03	7/8"	1721.54	7/8"	1737.05	7/8"	1752.56	7/8"	1768.07
15/16"	1811.27	15/16"	1827.89	15/16"	1844.51	15/16"	1861.13	15/16"	1877.74	15/16"	1894.36

[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

MATERIALS[1] WEIGHT[2] TABLES (T&D J Condensed Arrangement)

Calculated and Compiled by Geo. H. Thompson

	7 3/16" x		7 1/4" x		7 5/16" x		7 3/8" x		7 7/16" x		7 1/2" x
1"	2038.38	1"	2056.10	1"	2073.83	1"	2091.55	1"	2109.28	1"	2127.00
2"	4076.75	2"	4112.20	2"	4147.65	2"	4183.10	2"	4218.55	2"	4254.00
3"	6115.13	3"	6168.30	3"	6221.48	3"	6274.65	3"	6327.83	3"	6381.00
4"	8153.50	4"	8224.40	4"	8295.30	4"	8366.20	4"	8437.10	4"	8508.00
5"	10191.90	5"	10280.50	5"	10369.10	5"	10457.80	5"	10546.40	5"	10635.00
6"	12230.30	6"	12336.60	6"	12443.00	6"	12549.30	6"	12655.70	6"	12762.00
7"	14268.60	7"	14392.70	7"	14516.80	7"	14640.90	7"	14764.90	7"	14889.00
8"	16307.00	8"	16448.80	8"	16590.60	8"	16732.40	8"	16874.20	8"	17016.00
9"	18345.40	9"	18504.90	9"	18664.40	9"	18824.00	9"	18983.50	9"	19143.00
10"	20383.80	10"	20561.00	10"	20738.30	10"	20915.50	10"	21092.80	10"	21270.00
11"	22422.10	11"	22617.10	11"	22812.10	11"	23007.10	11"	23202.00	11"	23397.00
12"	24460.50	12"	24673.20	12"	24885.90	12"	25098.60	12"	25311.30	12"	25524.00
1/16"	127.40	1/16"	128.51	1/16"	129.62	1/16"	130.73	1/16"	131.83	1/16"	132.94
1/8"	254.80	1/8"	257.01	1/8"	259.23	1/8"	261.44	1/8"	263.66	1/8"	265.88
3/16"	382.20	3/16"	385.52	3/16"	388.85	3/16"	392.17	3/16"	395.49	3/16"	398.81
1/4"	509.59	1/4"	514.03	1/4"	518.46	1/4"	522.89	1/4"	527.32	1/4"	531.75
5/16"	636.99	5/16"	642.53	5/16"	648.07	5/16"	653.61	5/16"	659.15	5/16"	664.69
3/8"	764.39	3/8"	771.04	3/8"	777.68	3/8"	784.33	3/8"	790.98	3/8"	797.63
7/16"	891.79	7/16"	899.54	7/16"	907.30	7/16"	915.05	7/16"	922.81	7/16"	930.56
1/2"	1019.19	1/2"	1028.05	1/2"	1036.91	1/2"	1045.78	1/2"	1054.64	1/2"	1063.50
9/16"	1146.59	9/16"	1156.56	9/16"	1166.53	9/16"	1176.50	9/16"	1186.47	9/16"	1196.44
5/8"	1273.98	5/8"	1285.06	5/8"	1296.14	5/8"	1307.22	5/8"	1318.30	5/8"	1329.38
11/16"	1401.38	11/16"	1413.57	11/16"	1425.75	11/16"	1437.94	11/16"	1450.13	11/16"	1462.31
3/4"	1528.78	3/4"	1542.08	3/4"	1555.37	3/4"	1568.66	3/4"	1581.96	3/4"	1595.25
13/16"	1656.18	13/16"	1670.58	13/16"	1684.98	13/16"	1699.38	13/16"	1713.79	13/16"	1728.19
7/8"	1783.58	7/8"	1799.09	7/8"	1814.60	7/8"	1830.11	7/8"	1845.62	7/8"	1861.13
15/16"	1910.98	15/16"	1927.59	15/16"	1944.21	15/16"	1960.83	15/16"	1977.45	15/16"	1994.06

[1] Based on a steel of 1 cu. in. = .2836 lb.

[2] Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

MATERIALS[1] WEIGHT[2] TABLES (T&DJ Condensed Arrangement)

Calculated and Compiled by Geo. H. Thompson

7 9/16" x		7 5/8" x		7 11/16" x		7 3/4" x		7 13/16" x		7 7/8" x	
1"	2144.73	1"	2162.45	1"	2180.18	1"	2197.90	1"	2215.63	1"	2233.35
2"	4289.45	2"	4324.90	2"	4360.35	2"	4395.80	2"	4431.25	2"	4466.70
3"	6434.18	3"	6487.35	3"	6540.53	3"	6593.70	3"	6646.88	3"	6700.05
4"	8578.90	4"	8649.80	4"	8720.70	4"	8791.60	4"	8862.50	4"	8933.40
5"	10723.60	5"	10812.30	5"	10900.90	5"	10989.50	5"	11078.10	5"	11166.80
6"	12868.40	6"	12974.70	6"	13081.10	6"	13187.40	6"	13293.80	6"	13400.10
7"	15013.10	7"	15137.20	7"	15261.20	7"	15385.30	7"	15509.40	7"	15633.50
8"	17157.80	8"	17299.60	8"	17441.40	8"	17583.20	8"	17725.00	8"	17866.80
9"	19302.50	9"	19462.10	9"	19621.60	9"	19781.10	9"	19940.60	9"	20100.20
10"	21447.30	10"	21624.50	10"	21801.80	10"	21979.00	10"	22156.30	10"	22333.50
11"	23592.00	11"	23787.00	11"	23981.90	11"	24176.90	11"	24371.90	11"	24566.90
12"	25736.70	12"	25949.40	12"	26162.10	12"	26374.80	12"	26587.50	12"	26800.20
1/16"	134.05	1/16"	135.16	1/16"	136.27	1/16"	137.37	1/16"	138.48	1/16"	139.59
1/8"	268.09	1/8"	270.31	1/8"	272.52	1/8"	274.74	1/8"	276.95	1/8"	279.17
3/16"	402.14	3/16"	405.46	3/16"	408.79	3/16"	412.11	3/16"	415.43	3/16"	418.75
1/4"	536.18	1/4"	540.61	1/4"	545.04	1/4"	549.48	1/4"	553.91	1/4"	558.34
5/16"	670.23	5/16"	675.77	5/16"	681.31	5/16"	686.84	5/16"	692.38	5/16"	697.92
3/8"	804.27	3/8"	810.92	3/8"	817.57	3/8"	824.21	3/8"	830.86	3/8"	837.51
7/16"	938.32	7/16"	946.07	7/16"	953.83	7/16"	961.58	7/16"	969.34	7/16"	977.09
1/2"	1072.36	1/2"	1081.23	1/2"	1090.09	1/2"	1098.95	1/2"	1107.81	1/2"	1116.68
9/16"	1206.41	9/16"	1216.38	9/16"	1226.35	9/16"	1236.32	9/16"	1246.29	9/16"	1256.26
5/8"	1340.45	5/8"	1351.53	5/8"	1362.61	5/8"	1373.69	5/8"	1384.77	5/8"	1395.84
11/16"	1474.50	11/16"	1486.68	11/16"	1498.87	11/16"	1511.06	11/16"	1523.24	11/16"	1535.43
3/4"	1608.54	3/4"	1621.84	3/4"	1635.13	3/4"	1648.43	3/4"	1661.72	3/4"	1675.01
13/16"	1742.59	13/16"	1756.99	13/16"	1771.39	13/16"	1785.79	13/16"	1800.20	13/16"	1814.60
7/8"	1876.63	7/8"	1892.14	7/8"	1907.65	7/8"	1923.16	7/8"	1938.67	7/8"	1954.18
15/16"	2010.68	15/16"	2027.30	15/16"	2043.91	15/16"	2060.53	15/16"	2077.15	15/16"	2093.77

[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

MATERIALS[1] WEIGHT[2] TABLES (T&DJ Condensed Arrangement)

Calculated and Compiled by Geo. H. Thompson

	7 1/8" x		8.00" x		8 1/16" x		8 1/8" x		8 3/16" x		8 1/4" x
1"	2251.08	1"	2268.80	1"	2286.53	1"	2304.25	1"	2321.98	1"	2339.70
2"	4502.15	2"	4537.60	2"	4573.05	2"	4608.50	2"	4643.95	2"	4679.40
3"	6753.23	3"	6806.40	3"	6859.58	3"	6912.75	3"	6965.93	3"	7019.10
4"	9004.30	4"	9075.20	4"	9146.10	4"	9217.00	4"	9287.90	4"	9358.80
5"	11255.40	5"	11344.00	5"	11432.60	5"	11521.30	5"	11609.90	5"	11698.50
6"	13506.50	6"	13612.80	6"	13719.20	6"	13825.50	6"	13931.90	6"	14038.20
7"	15757.50	7"	15881.60	7"	16005.70	7"	16129.80	7"	16253.80	7"	16377.90
8"	18008.60	8"	18150.40	8"	18292.20	8"	18434.00	8"	18575.80	8"	18717.60
9"	20259.70	9"	20419.20	9"	20578.70	9"	20738.30	9"	20897.80	9"	21057.30
10"	22510.80	10"	22688.00	10"	22865.30	10"	23042.50	10"	23219.80	10"	23397.00
11"	24761.80	11"	24956.80	11"	25151.80	11"	25346.80	11"	25541.70	11"	25736.70
12"	27012.90	12"	27225.60	12"	27438.30	12"	27651.00	12"	27863.70	12"	28076.40
1/16"	140.70	1/16"	141.80	1/16"	142.91	1/16"	144.02	1/16"	145.12	1/16"	146.23
1/8"	281.38	1/8"	283.60	1/8"	285.82	1/8"	288.03	1/8"	290.25	1/8"	292.46
3/16"	422.08	3/16"	425.40	3/16"	428.72	3/16"	432.05	3/16"	435.37	3/16"	438.69
1/4"	562.77	1/4"	567.20	1/4"	571.63	1/4"	576.06	1/4"	580.49	1/4"	584.93
5/16"	703.46	5/16"	709.00	5/16"	714.54	5/16"	720.08	5/16"	725.62	5/16"	731.16
3/8"	844.15	3/8"	850.80	3/8"	857.45	3/8"	864.09	3/8"	870.74	3/8"	877.39
7/16"	984.85	7/16"	992.60	7/16"	1000.35	7/16"	1008.11	7/16"	1015.86	7/16"	1023.62
1/2"	1125.54	1/2"	1134.40	1/2"	1143.27	1/2"	1152.13	1/2"	1160.99	1/2"	1169.85
9/16"	1266.23	9/16"	1276.20	9/16"	1286.17	9/16"	1296.14	9/16"	1306.11	9/16"	1316.08
5/8"	1406.92	5/8"	1418.00	5/8"	1429.08	5/8"	1440.16	5/8"	1451.23	5/8"	1462.31
11/16"	1547.61	11/16"	1559.80	11/16"	1571.99	11/16"	1584.17	11/16"	1596.36	11/16"	1608.54
3/4"	1688.31	3/4"	1701.60	3/4"	1714.89	3/4"	1728.19	3/4"	1741.48	3/4"	1754.78
13/16"	1829.00	13/16"	1843.40	13/16"	1857.80	13/16"	1872.20	13/16"	1886.60	13/16"	1901.01
7/8"	1969.69	7/8"	1985.20	7/8"	2000.71	7/8"	2016.22	7/8"	2031.73	7/8"	2047.24
15/16"	2110.38	15/16"	2127.00	15/16"	2143.62	15/16"	2160.23	15/16"	2176.85	15/16"	2193.47

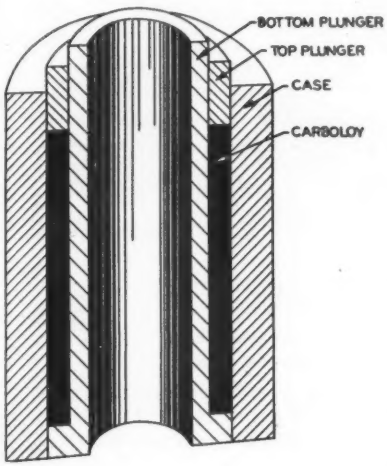
[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

Simplification of Powder Metallurgy Operations

The production of cemented carbide parts too large to be sintered in available furnaces—as well as special, thin-walled parts that tend to go out of round when pressed and then sintered in the regular way—has been made possible at Carboloy Company, Inc., 11109 E. 8 Mile Rd., Detroit, Mich., by the development of a "hot press" method which incorporates in one single operation the three distinct processes of pressing, semi-sintering and sintering.

The procedure, which employs electrical resistance heating to obtain the necessary sintering temperature, makes use of an hydraulic press capable of exerting a forming pressure of one hundred tons. This press is equipped with water-cooled platens and is very similar to a "press-welder". Heat is supplied through a 750 KVA transformer and is controlled by General Electric electronic contactors. The press now in regular operation at Carboloy handles jobs up to 100 square inches in cross section, although this is limited at present to an 18" diameter and an 8" maximum height of work.



The molds in which the parts are pressed and sintered are of a graphite-base composition. The molds, for dies for instance, are composed of an outer case, an inner core or bottom plunger, and a ring or top plunger to squeeze down the carbide powder between them. The inner core of the mold has a corresponding flange around its bottom to retain the metallic powder. The powder volume must be carefully calculated and measured since the density of the finished piece depends upon how much material there is in the carbide part when the squeeze-ring or top plunger has been brought flush with the top of the mold at the end of the operation.

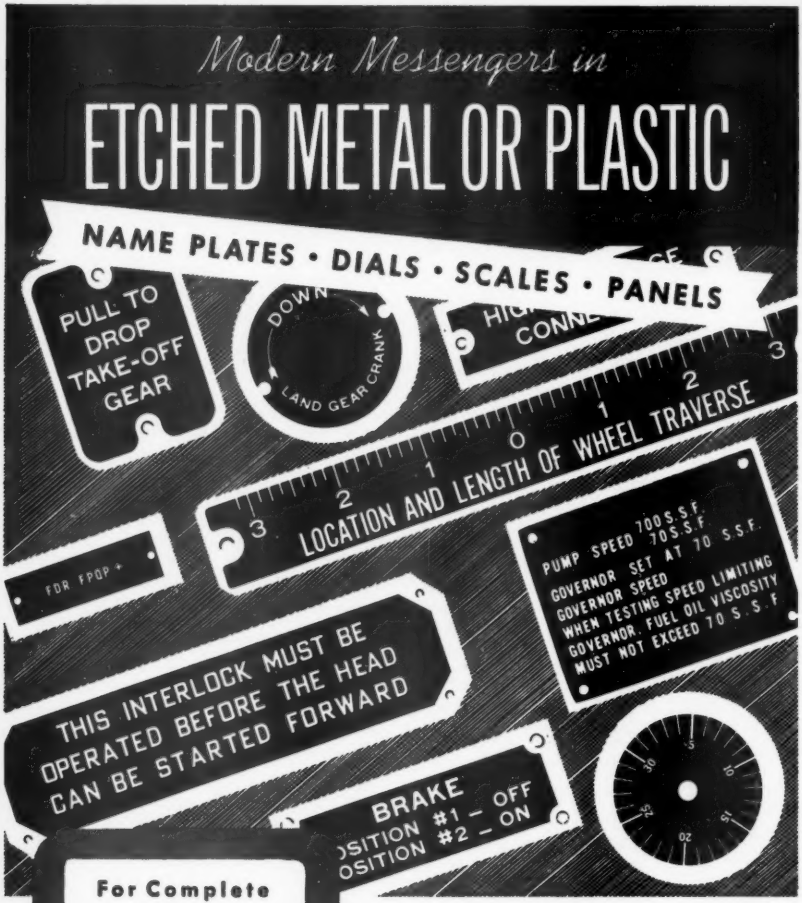
When fabricating the larger die nibs, the mold with its content of metal powder is often pre-heated in a "portable" furnace. This auxiliary heating unit has a controlled hydrogen atmosphere to protect both the graphite mold and the molybdenum heating wires. When the pre-heating is finished, the furnace —together with the mold containing the metal powder—is pulled from its position to a location directly underneath the press platen by means of a steel cable. Usually, the pre-heating furnace is left running during the entire process of hot-pressing so that the heating operation is actually continuous.

Hot pressing of large die nibs is, of course, necessarily a relatively slow process to assure even heating throughout and so as not to require impractically high current densities. During the process, two pressures are used—a "normal" pressure and the super-imposed final pressure. This latter is effective at approximately the final sintering temperature. At the beginning of the operation, the pressure head travels fairly fast but slows down considerably as the compression increases. For this reason, the final one-eighth inch of movement is under the higher pressure.

When sintering is completed, the part is removed from its mold. Each finished piece is checked thoroughly for density and hardness. Included among the parts which are now being produced by this method are long, thin hollow pieces such as shell nosing dies for 90 mm. and 105 mm. shells, tapering and casing dies for the same caliber ammunition and broaching rings for finishing aircraft engine silver-lined bearings. The rings for these broaches must be extremely thin and entirely free from porosity. 82-K

Modern Messengers in

ETCHED METAL OR PLASTIC


NAME PLATES • DIALS • SCALES • PANELS
PULL TO DROP TAKE-OFF GEAR
DOWN
LAND GEAR CRANK
3 2 1 0 1 2 3
LOCATION AND LENGTH OF WHEEL TRAVERSE
PUMP SPEED 700 S.S.F.
GOVERNOR SET AT 70 S.S.F.
GOVERNOR SPEED WHEN TESTING SPEED LIMITING GOVERNOR. FUEL OIL VISCOSITY MUST NOT EXCEED 70 S.S.F.
THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD
BRAKE
OSITION #1 – OFF
OSITION #2 – ON

For Complete Details write

Eastern Etching AND MFG. CO.
Chicopee, Mass.

Eastern Etching's prompt deliveries help speed your war production.

Normal deliveries—Two Weeks
Emergency orders—48 hours.

TOOL CHECKS • DATA & INSTRUCTION PLATES • DIALS • SCALES • INSTRUMENT PANELS • ETCHED & LITHOGRAPHED PRODUCTS

ORIGINATORS OF "ETCHED" PLASTIC

LASTING • LEGIBLE • ATTRACTIVE • INEXPENSIVE

INDUSTRIAL PLASTICS

Procedures in Plastics

THERMOPLASTIC MATERIALS

By Warren V. Prince

This is a continuation of a survey of the twenty main types of plastics materials. We have covered the five thermosetting materials briefly in the last article. Here the fifteen main types of thermoplastic materials will be treated in the same manner.

A thorough understanding of the differences between plastics materials is of utmost importance in intelligently selecting the proper material for any application. It is not necessary for the designer or molder of plastics products to be a chemist or chemical engineer any more than it is necessary for a machine designer, a die or mold maker to be a metallurgist. It is necessary that a sound basic knowledge of physical characteristics of commercially available types of materials be acquired as a foundation for design procedures and molding techniques.

This discussion will be brief and place emphasis on the most outstanding characteristics and distinctive uses of thermoplastic materials. Later each material will be treated separately and problems of design, production and applications will be studied in detail.

The fifteen main types of thermoplastic materials are:

(1) Cellulose Nitrate
(2) Cellulose Acetate
(3) Cellulose Acetate Butyrate
(4) Ethyl Cellulose
(5) Vinyl Plastics
(6) Polystyrene
(7) Acrylic Plastics
(8) Vinylidene Chloride
(9) Nylon Resins
(10) Casein
(11) Cumarone-Indene
(12) Shellac
(13) Polyethylene
(14) Synthetic Rubbers
(15) Cold Molding Compounds (non-refractory)

The cellulose plastics, comprising the first four types, are made from cellulose materials such as cotton and wood pulp, and are made to chemically combine with various chemicals such as nitric acid, acetic acid, acetic anhydride, butyric acid, ethylating agents, etc., depending upon the variety of resin desired.

Cellulose Nitrate

The first plastics material to be developed commercially was cellulose nitrate which got its start in 1868 when John Wesley Hyatt produced the first "Celluloid" for use in billiard balls to replace ivory. The resins are basically water clear and have a full color range. By water clear we mean both transparent and colorless. Camphor is the universal plasticizer to control the physical properties and this can usually be detected in the finished part by the persistent odor of the camphor. This material is the most inflammable of all plastics and burns rapidly when ignited. The price is very low compared with other plas-

tics materials. It can be readily joined by solvent cements.

It is used widely for its artistic coloring effects as for example in such items as dresser sets and fountain pens. Clear transparency is generally not very permanent and sunlight causes discoloration, as it was learned with the original safety glass materials a few years ago. The impact strength is excellent and

Ethyl cellulose molding material and finished product. The granular material as shown molds into the gas mask parts as shown. The bulk factor is 2.2 to 2.5 to 1.

such items as hammer heads and screwdriver handles are made of cellulose nitrate for that reason.

Other uses are for backing for motion picture and photographic film, for toy animals, buttons, and inexpensive novelties.

Cellulose nitrate is usually available as sheets, rods, and tubes. It can be compression molded, but with difficulty. Injection molding cannot be done due to its sensitivity to high temperatures. Common trade names are "Amerith", "Celluloid", "Nixonoid", and "Pyralin."

Cellulose Acetate

This is the most widely used of all thermoplastic materials and lends itself readily to all types of thermoplastic mass production methods. It is the most widely used material for injection molding. It is also molded by extrusion.

The acetates are less inflammable than the nitrates and have better resistance to sunlight. A full color range is possible and the basic resin is water clear. The price is higher than the nitrates. It has good welding properties, is softer than the nitrates, has better color stability and impact strength. By welding properties we mean the fusing together of two heat softened surfaces. Cementing, which is the fusing of two solvent softened surfaces, is sometimes referred to as welding.

The acetates, by means of using various types and quantities of plasticizers, have a wide range of physical properties as a thermoplastic material. The acetates generally have good machining properties and will withstand a wide range of finishing operations.

There are some 300 different applications on automobiles alone, most of which are injection molded. Safety glass is perhaps its largest single use. In this case the lightfastness is much superior to the cellulose nitrates. Other automotive uses are knobs, handles, steering wheels, ornamental grills, etc.

Buttons, combs, fountain pens and automatic pencils, goggles and goggle frames, desk accessories, soap dishes and dispensers, photographic safety film, wrapping paper, and many other items illustrate the widespread use of acetates. Outstanding physical properties are mechanical strength, dielectric strength, transparency and colorability.

Some common trade names are "Tenite I", "Lumarith", "Vuelite", "Plastacele", and "Bakelite Cellulose Acetate".

Cellulose Acetate Butyrate

The butyrates are very similar to the acetates in nearly all respects and are superior in impact strength at low temperatures, resistance to distortion under heat, and are more weather and water resistant since they absorb about half as much water as the acetates. The tensile and compression strengths are a little lower and the dimensional stability is better. Both the acetates and butyrates mold to a good finish.

Butyrate is very widely used in war applications because of its weather resistance. Other uses are garden hose nozzles and couplings, weather stripping, gun-stocks, toothbrush and shaving brush handles, wallboard trim, shower heads, etc. It is available in all colors and is particularly adaptable to extrusion. It is characterized by a mildly sickening odor which becomes much more predominant when burned. The most common trade name is "Tenite II".

Ethyl Cellulose

Ethyl cellulose is very similar to the acetates and butyrates in most of the important properties, but it is the best of all thermoplastics in low temperature shock resistance. It does not get very brittle at low temperatures. Other outstanding characteristics are toughness and strength. It retains its original properties on aging and on exposure to wide range of temperature and humidity conditions. Dimensional stability is good over a wide temperature range. The raw materials for manufacture are plentiful even in wartime.

Special materials have been developed for injection molding, compression molding, extrusion, and extrusion wire coating. Ethyl cellulose is soluble in a wide variety of organic solvents. The colorability is very good and the electrical characteristics are above average.

Typical uses of ethyl cellulose are army canteens, forming dies for alumi-

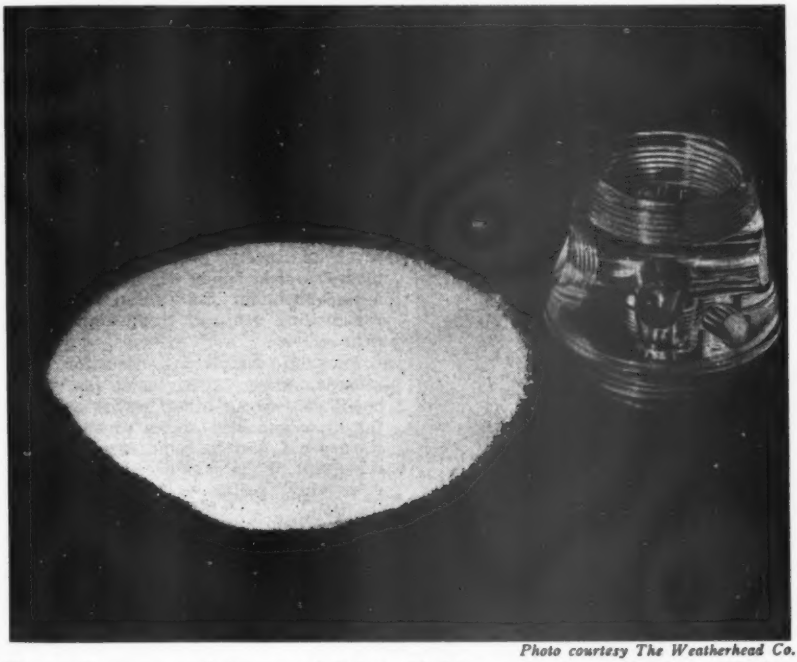


Photo courtesy The Weatherhead Co.

The acrylic compound shown at left is molded into a display model for a M52 fuze body shown at the right. The bulk factor is 1.6 to 2.2 to 1.

num sheeting in aircraft, hose nozzles and fittings, and some rubber-like articles. The materials are available from several manufacturers, the most common of which are under the trade names of "Ethocel", "Ethofoil" and "Hercules Ethyl Cellulose."

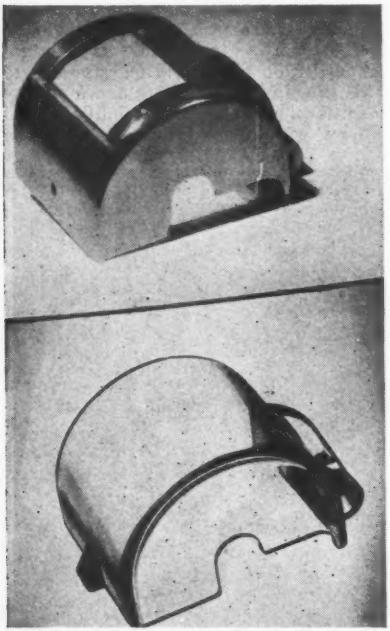


Photo courtesy General Electric Plastics Div.

The cellulose acetate safety guard, below, replaced the aluminum unit shown above. The part is pre-war fabricated.

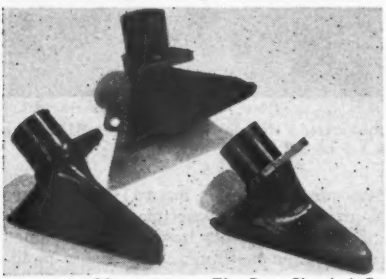


Photo courtesy The Dow Chemical Co.

De-icer nozzles for army planes made of LT Ethocel (ethyl cellulose and designed for low temperature work).

Vinyl Plastics

Vinyl plastics in general are rubber-like plastics and more closely resemble rubber than plastics. However, some formulations can produce materials which, from appearance and feeling, cannot be distinguished from many of the cellulose plastics.

The vinyls are available under many different chemical names such as vinyl chloride acetate, polyvinyl chloride, polyvinyl alcohol, polyvinyl butyral, etc. Polystyrene, vinylidene chloride, and acrylic resins, are in the same chemical family but will be discussed separately.

These copolymers, which are made by polymerization of two or more substances, do not possess a true melting point since they usually soften gradually when heated. They do not support combustion and have unusual chemical inertness, which are very advantageous properties. Many are used for lacquers and varnishes. Strong adhesive properties are responsible for its uses as the inner layer of safety glass, "Scotch" tape, plastic wood, paper drinking cups and milk containers. Solutions are used cold for sealing leather, tamper-proof bottles, etc.

The rigid vinyls are used for music records, paper clips, and instrument housings. Some other resins are used for impregnating fabrics to make them waterproof and in some cases to make them stiff. Food cans are lined or coated with vinyl resins to prevent chemical reaction.

The rubber-like vinyls are used to replace rubber and synthetic rubber articles. Polyvinyl chloride, when plasticized, is superior to rubber in flexing life, resistance to sunlight, oxidation, acids, water, etc. However, no plastics material or synthetic rubber has been able to equal rubber in elasticity or in wear resistance from abrasion. One of the largest advantages over natural or synthetic rubber is the extremely rapid production rate in comparison since the vinyls do not have to be cured.

Some vinyls are used for men's belts, suspenders, wrist watch bands, etc. A few trade names are "Vinylite", "Koroseal", "Saflex" and "Geon."

Polystyrene

Polystyrene is the best known of the plastics materials for outstanding elec-

trical properties. It has a very low power factor and high dielectric strength which means that it does not affect sensitive electrical circuits as for example radio circuits, and is an excellent electrical insulator. For certain applications they equal the electrical properties of fused quartz which they are replacing. The water absorption is extremely low, which partly accounts for the good electrical properties.

Polystyrene is the hardest and most rigid of the thermoplastics. It has the property of hardening from polymerization due to heat, and the more it is heated the harder it gets. After being once molded or fabricated, it cannot be remelted at the same temperature, but requires a higher temperature each time.

The weight is very light, having about the same specific gravity as water. When normally molded in thin sections, polystyrene has a characteristic metallic ring when tapped with the finger nail or struck a sharp blow. This is a simple way of identifying this material.

It is one of the most popular injection molded materials and has brilliant and unusual color effects. The basic resin is water clear.

Other uses are for lenses, battery cases, insulating sheeting, cosmetic boxes, electrical insulators, etc. Common trade names are "Loalin", "Styron", "Lustron", and "Bakelite Polystyrene".

Acrylic Plastics

Most common of the acrylics are the methyl methacrylates. Acrylics are the most clear and transparent of all plastics. They are even more transparent than glass and are widely used in the optical and ornamental fields. Bomber noses, turret tops, and windows are made of heavy acrylic plastics sheeting instead of glass, because it withstands the shock of gunfire and nearby explosion.

Acrylics have good permanency of dimensions after molding and are almost as hard as the polystyrenes. For lenses and other optical uses, however, these plastics are much more easily scratched than glass and should be avoided where abrasion is likely.

As liquid resins they have good adhesiveness. Safety glass inner layer is applied as a liquid instead of sheeting and needs no sealing at the edges.

The color range is unexcelled due to

Photo courtesy Tennessee-Eastman Corp.

The handle of this portable indicating comparator is made of Tenite (cellulose acetate molding compound). The low thermal conductivity of the Tenite prevents the heat of the operator's hand from affecting the accuracy of the indicating elements of the comparator. Handles molded by Precision Plastics Company, Philadelphia, Pa., for Bellweather Laboratories, Upper Darby, Pa.

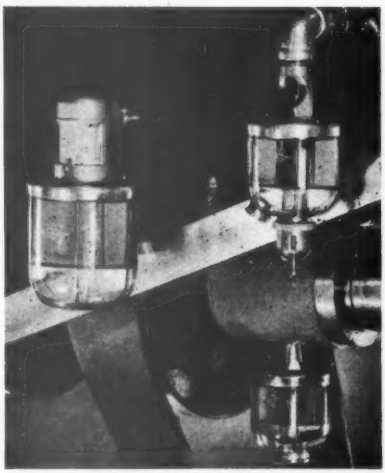


Photo courtesy Tennessee-Eastman Corp.

Oil cups of transparent Tenite. The material is non-hazardous in the presence of fire, shatterproof and is not affected by ordinary lubricating oils. Molded by Trico Fuse Manufacturing Co., Milwaukee, Wisc.

the extreme clearness. It is used for automotive dashboard parts and horn buttons, dentures, displays and ornamental fixtures, artificial eyes and contact eye lenses to replace eye glasses,

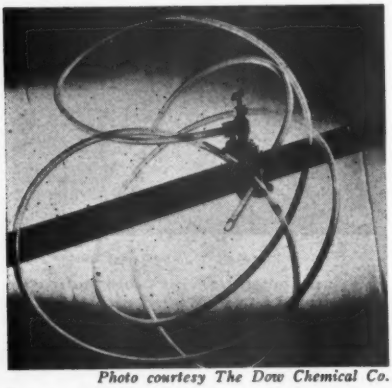


Photo courtesy The Dow Chemical Co.

Saran translucent tubing is exceptionally flexible and its resistance to chemicals makes it particularly useful in conveying highly corrosive liquids.

Photo courtesy The Dow Chemical Co.

New extrusion techniques in processing Saran makes possible pipe with a wall thickness to 3/8" and a pipe size of 4". One use of Saran pipe is as an electrical insulation medium for cooling pipe on electrical rectifying equipment.

lighting effects where diffusion through letters and figures is desired, dials and lenses, flashlight rod attachments for bending light, etc.

The most common trade names are "Lucite" and "Plexiglas".

Vinylidene Chloride

More commonly known by their trade names "Saran", and "Velon", these materials are most popularly used for thermoplastic tubing and fittings. Due to the softness, however, these fittings can only be finger-tightened. A wrench must not be used.

Vinylidene chloride is the most chemical resistant of all plastics. It resists strong acids and alkalis, organic solvents, and nearly all chemicals. Ammonia is the only common chemical which affects it. The water absorption is extremely low and with some formulations are the lowest of all plastics at room temperature.

In the presence of a flame it gives off a very pungent odor, but is not flammable. As it melts in the flame it swells into a black pithy mass.

Steel molds or any iron- or copper-base metals should not be used with vinylidene chloride because these metals cause thermal decomposition and the metals are attacked chemically. Chrome, nickel and magnesium alloys must be used.

Vinylidene chloride is used also for its flexibility and fatigue strength. When extruded as filaments, it is used extensively as woven fabrics in beautiful colors. These fabrics are far superior to other textile fabrics in wear resistance, as in the case of transportation seat covers. Other uses are for plating racks, spray gun handles, low pressure valve seats, home screening, fireproof coatings and battery cases.

Nylon Resins

There are two main types of nylon plastics—extruded filament nylon used for textiles, bristles, etc., and nylon molding materials used for injection molded parts.

Filament nylon when cold drawn after extrusion has the highest tensile strength of any plastics material. Cold drawing increases the tensile strength from 15,000 psi to 50,000 psi. This accounts for its vastly superior properties as a textile or bristle. Along with that goes water resistance, which non-plastic filaments cannot offer. During the war they are used most widely for parachutes and industrial brushes. In post-war they will be used for hose and other types of clothing, tooth and toilet brushes, paint brushes, and fishing kits. Elasticity,

toughness, and resistance to cleaning fluids are important properties.

Molded nylon is a recent and very important development in the plastics industry. This is the most heat resistant of all thermoplastics and is exceptionally tough and flexible throughout a wide range of temperatures. They have a sharp melting point of around 470° F to 480° F and are the only plastics material that flows as a liquid at the molding temperatures. This makes mold cavities easy to fill, but so far can only be successfully molded by injection. Unfortunately, the only color available is a translucent light cream color, due to the fact that dyes are not stable at the high molding temperatures, but moldings may be dyed by after-treatment.

Special nozzles are required on the injection machine to prevent the liquid nylon from flowing out when the mold is open.

Injection molded nylon is very critical at present during the war and has many uses where toughness, high temperature resistance, resiliency, and high tensile strength are required. Trade name is "Nylon".

Casein

Casein plastics are protein plastics obtained from skimmed milk which is curded with rennet. They are not truly thermoplastic because after the desired shape is obtained, it is necessary to chemically cure or harden them in a formaldehyde bath.

Casein articles are formed or machined rather than molded. Materials are available only as sheets, rods, tubing, and discs. Articles such as buttons are usually machined and chemically hardened afterward. Many novelties, buckles, beads, handles, and trimming accessories are made of casein.

They are easily polished to a high finish, are non-inflammable, and absorb moisture very readily, usually resulting in warping if sections are too large and thin. Some materials are soaked in water to a point of softness at which they may be worked to any desired shape. Casein is readily joined by a special casein glue. Casein is generally lower in cost than any of the thermoplastic resins. Trade names include "Ameroid" and "Galorn". Another source of protein plastics—the soybean—may be mentioned. However, because of the critical demand for the soybean as a food because of its high protein content and the military demand for low cost adhesives, it is practically out of the molding picture at present.

Cumarone-Indene

Indene plastics are usually not available as molding materials but are furnished as liquids and used mostly for mastic floor tile, protective coatings, chewing gum (to replace chicle), and to facilitate rubber and synthetic rubber compounding. As resins they have brittleness and low tensile strength. Their largest uses lie in the improvement of other materials since they are compatible with nearly all other resins. The raw materials for indene come from naphtha. Common trade names are "Cumar", "Piccoumaron Resins" and "Nevillac".

Shellac

Used both as molding materials and coatings, shellac is obtained from insect

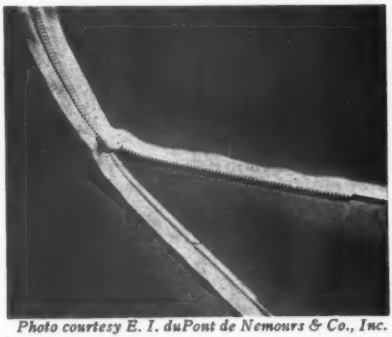


Photo courtesy E. I. duPont de Nemours & Co., Inc.

An experimental slide fastener molded of nylon.

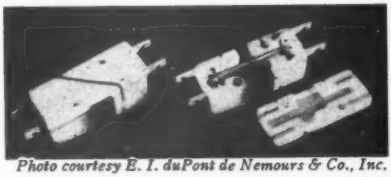


Photo courtesy E. I. duPont de Nemours & Co., Inc.

A small electric switch housing molded of nylon. Two switches are shown: at the left is the complete switch; at the right the cover is removed to show inserted and actuating elements of the switch.

secretions, most of which come from India. Prolonged or repeated heating causes these resins to slowly become thermosetting if carried far enough.

Shellac is frequently used as a binder for paper and insulating sheets. When molded it is usually mixed with plasticizers or fillers and exhibits both thermoplastic and thermosetting properties, depending upon the processing. Switch parts are often made of shellac, but due to their low softening point the maximum temperature is limited. Telephone earpieces and mouthpieces can be molded to a high gloss.

Polyethylene

This is the newest of the plastics and so far has not had many applications other than in sheeting. It is a wax-like material in texture and of waxy-white translucent appearance. It has unusual flexibility and toughness over a wide range of temperatures along with excellent water resistance and chemical inertness. "Polythene", which is the most common trade name, can be molded by injection or compression or extrusion.

It is used for collapsible tubes for food or cosmetics, battery parts, gaskets, covering for electrical wiring, and sheets for electrical uses. The impact strength is the highest of all plastics. Thermal expansion is extremely high — about 12½% in volume—from molding temperature to room temperature. The surface is rather poor. Sulphuric and hydrochloric acids have no effect. Polyethylene is distinctly a soft plastics material.

Synthetic Rubbers

There are two classifications of synthetic rubbers—the thermoplastics which are the vinyl plastics already discussed, and the thermosetting variety which include Butyl Rubber, Butadiene (Buna S and Buna N), Neoprene, and Thiokol which are the five most important varieties. In reality, the thermosetting synthetic rubbers are in a class by themselves as far as physical properties are concerned.

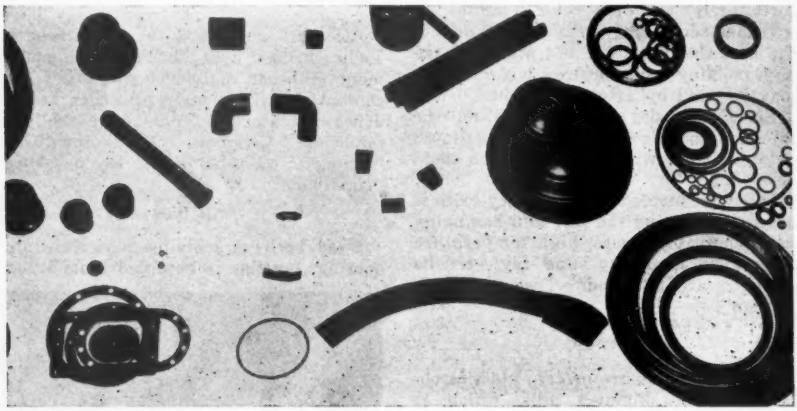


Photo courtesy The Goodyear Tire & Rubber Co.

A group of industrial products made from Chemigum N. Shown are seals and accumulators for hydraulic systems, gaskets, tubing, vibration dampeners and a sealing strip.

All of these synthetic rubbers are made of synthetic materials. Technically speaking they should not be called rubbers, but they are rubber-like in physical properties.

They are all superior to natural rubber in chemical resistance, oxygen resistance, and aging resistance, but are not quite as elastic, or wear resistant as in the case of tires. Some are mixed with natural rubber to improve their characteristics.

Butadiene rubbers are divided into two classes, Buna S (containing styrene),

and Buna N. Common trade names are "Hycar," "Chemigum", "Ameripol", and "Perbunan". *Buna S* is noted for its heat resistance, abrasion resistance, and is a very reliable material for consistency. Buna S is the type chosen for the major part of the synthetic rubber program to replace natural rubber. Buna S is the tire rubber of the immediate future. *Buna N* is unaffected by water, dilute acids and alkalis, salt solution, and has good resistance to gasoline and oils from the standpoint of swelling. Industrial applications include gasoline and oil hose, tank linings, gaskets, packings and "rubber" covered rolls.

Neoprene, a chloroprene rubber, has outstanding resistance to solvents, gasolines, and oils, but is more expensive than Butadiene rubbers. Introduced in 1932, Neoprene, first called Duprene, was the first commercially successful synthetic rubber. More than ten distinct neoprene types have been developed for particular properties.

Thiokol, which is an organic polysulphide, is unaffected by petroleum and most commercial solvents, and resists alcohol, ketones, and esters. The tensile strength is less than that of natural rubber.

Butyl rubber is a polymer of isobutylene, which is produced in quantity as a by-product in petroleum cracking. It has excellent impermeability to gases—a military advantage since it is resistant to mustard gas and one of the few materials resistant to Lewisite.

Butyl Rubber as compared to natural rubber has less bounce, is less permeable and more resistant to the action of air, oils and most chemicals and is less affected by age deterioration. However it is attacked by concentrated acids and oily products.

Photo courtesy The Goodyear Tire & Rubber Co.

Made of a buna type synthetic rubber, these examples of tubing seals and other parts give the "same degrees of efficiency and wearability" as equipment previously made with natural rubber.

Cold Molded Plastics (non-refractory)

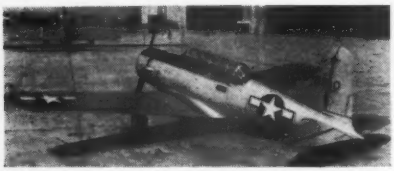
Some of the bitumens, a class of cold molded materials, are used mostly for storage battery boxes which must withstand considerable vibration and must not be affected by the battery acids used.

The special ingredients are melted and mixed with the fillers of asbestos or diatomaceous earth and then put in the mold as a hot plastic mass, which is pressed to shape and solidified by cooling the mold. These materials may be melted and reworked again.

Due to the demand for extra copies of Mr. Prince's articles, we propose to reprint the first five articles (of which this is the fourth) which, collectively, are a survey of the plastics materials and molding and fabricating methods. As soon as the June article covering the latter has been set in type, the reprint will be available.—The Editor

GLASS REINFORCED LAMINATES FOR STRUCTURAL PLANE PARTS

The application of Fiberglas as a reinforcement for plastics has undergone an important and possibly a very revolutionary development, according to technical and application data now revealed for the first time.*



This Army basic trainer has fuselage, side panels and tail cone of glass and resin laminated sheets.

Fiberglas fibers have been available in many diameters. The larger diameters have been utilized in mat form for air cleaning or filtering. Finer fibers, in the form of bats, blankets and boards, have been widely employed for heat and sound insulation. The finest fibers have been woven into cloths and tapes for use as electrical insulation and as industrial service fabrics.

War uses of Fiberglas have been many. The Navy in 1939 adopted glass fiber material as thermal insulation throughout all its fighting ships. Since the start of the war a glass fiber board faced with Fiberglas cloth is used both for thermal insulation and interior finish on Navy ships. The Army ground and air forces use Fiberglas as thermal insulation in cantonment buildings, portable shelters, refrigerators, portable food and water containers and ammunition trucks. Both Army and Navy planes use Fiberglas to insulate hulls and cabins. Fiberglas fulfills aviation's basic requirements—non-inflammability, light weight and low moisture pick-up. The latter characteristics proved to be most valuable on cargo ships flying to and through tropical atmospheres. A number of Fiberglas applications are still restricted.

The fabrication of glass-reinforced, low pressure plastics as laminated sheets is the newest application of Fiberglas to be removed from the restricted list. At Wright Field an Army basic trainer equipped with a glass-reinforced fuselage, side panels and tail cone has passed successful flight tests, completing a research program initiated by the Army Air Forces Materiel Command.

The experimental plastics fuselage is of sandwich construction. The sandwich consists of a balsa wood core between an inner and outer skin of a plastics material reinforced with fibrous glass cloth. Ground destruction tests of three fuselages of the same design—one of glass-reinforced plastics, one of metal, and one of plywood—indicate that for equivalent weight the glass sandwich fuselage is considerably the stronger. On a strength-weight basis the glass-reinforced fuselage is 50 percent stronger than the metal fuselage and 80 percent stronger than the wooden fuselage now in service. Firing tests have indicated that the glass reinforced fuselage would be satisfactory under gunfire.

While plastics, including glass-reinforced plastics, are now widely used in aircraft construction, they have been employed in non-structural applications. The Army Air Forces and the aviation industry have sought a high-strength, light-weight plastic material that can be molded into intricate shapes without high pressures, high temperatures or expensive molds, and that can be used for structural as well as non-structural aircraft parts.

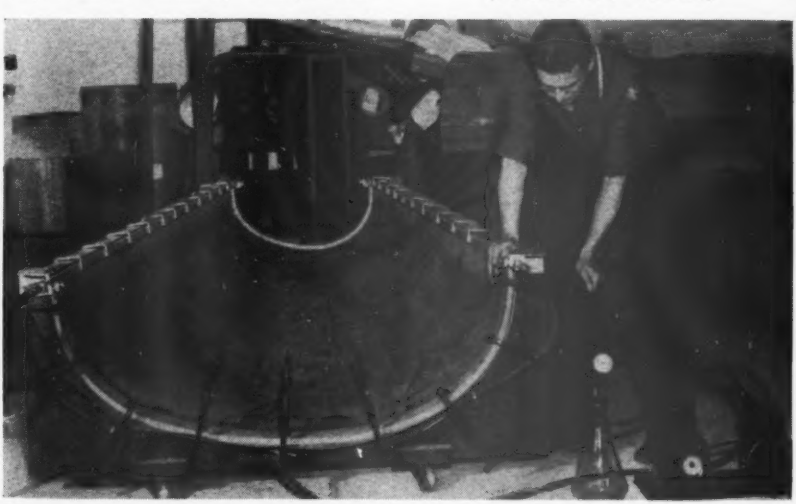
The fuselage, side panels and tail cone were fabricated at Wright Field. Research in the fabrication of the glass-reinforced laminates and their physical properties was conducted in the laboratories of Owens-Corning Fiberglas Corporation at Newark, Ohio. Resin manufacturers who cooperated by furnishing

*Data released by the Materiel Command, Army Air Forces, Wright Field, Dayton, Ohio.

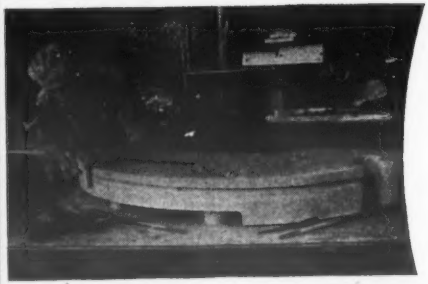
In fabricating the glass reinforced plastics fuselage, plies of resin impregnated glass cloth are laid over a male mold. The plies, comprising a complete half of the fuselage skin, are trimmed before transfer to the female mold.

resins for the research conducted in the Fiberglas laboratories are: American Cyanamid Company; Marco Chemicals, Inc.; Plaskon Division, Libbey-Owens-Ford Glass Company; Monsanto Chemical Company; Columbia Chemical Division, Pittsburgh Plate Glass Company;

(TO PAGE 98-P—PLEASE)



The assembly of impregnated plies of glass cloth and balsa wood core are placed in the female mold. A rubber blanket is laid over the assembly and sealed at the edges. A vacuum is drawn with the pump shown. The mold is rolled into an oven where it is baked at 220°F for three hours.



CATALIN a production-proven casting resin for tools and dies

Catalin Liquid Resin castings make possible new, low-cost tooling techniques for the fabrication of aluminum sheets. They excel as drill and saw jigs; router, shaper, and hydro form blocks; checking fixtures, stretch press molds and dies . . . particularly when contours are involved. Because these resins flow freely, they can be quickly, accurately and economically cast in plaster molds at your own plant. If required, finished castings can be machined as easily as brass or hardwood—and on standard shop equipment.

Tools, so cast, incorporate attributes necessary for mass production of precision parts . . . High compressive strength (20,000-25,000 lbs. per sq. in.); low water absorption [0.4-0.6 (24 hr.)]; dimensional stability; light weight. The resultant smooth, mirror-like surfaces eliminate uneven stretching, "orange-peeling", wrinkling and rupturing.

Catalin engineers are very active in this field . . . They'll be glad to share with you their knowledge, experience and know-how. Inquiries invited.

CATALIN CORPORATION

ONE PARK AVENUE • NEW YORK 16, N. Y.

Catalin

CAST RESINS
MOLDING COMPOUNDS
LIQUID RESINS

Photos courtesy of Curtiss-Wright Corp.

(CONTINUED FROM PAGE 98-M)
Dow Chemical Company; and the Bakelite Corporation. These resins, in combination with glass fibers, lend themselves to low-cost production methods adaptable to experimental and production designs.

The glass reinforcements employed in fabricating the laminates were heat-treated Fiberglas cloths and short, fine fibers known as Fiberglas flock. The resins were Plaskon 900, Laminac P-4122, MR-1A, Monsanto 38691, CR-39, and CR-149. Each of various combinations of glass and resin was fabricated into one-quarter and one-half-inch-thick laminated sheets.

The sheets were cured at a pressure of 15 pounds per square inch in an electrically heated hot air oven. Specimens were cut from the cured sheets and were machined and tested. Test results indicate that on a strength to weight ratio, glass cloth laminates possess physical properties comparable to those of a number of the metal alloys now used for aircraft structural parts.

Fiberglas possesses a number of characteristics that, when used as a reinforcement for plastics, give a combination resulting material that has hitherto unattainable strength in proportion to weight and permits fast, low-cost fabrication. Glass as a reinforcement will not burn, its resistance to high temperatures giving it a large safety factor for any molding or fabricating techniques that, conceivably, may be encountered. Glass will not absorb moisture, shrink or stretch. Dimensional stability of machined Fiberglas-plastics parts approximates that of the metals. Fiberglas-reinforced laminates can be designed, when necessary, with a shrinkage or expansion factor to match that of metals to which they may be joined, the control being effective through varying working temperatures. Glass fiber and plastics combinations are readily machinable with carbide tipped tools.

Tensile strengths of the Fiberglas laminated materials were found to be proportional to the amount of glass present in the laminates, and varied from 43,360 to 54,720 psi. Compression strengths as high as 56,820 psi were obtained. Flexural values ranged between 45,350 and 84,600 psi. Impact strengths of unnotched specimens were from 28.82 to 31.25 ft. lb. Ordinary plastics compounds have an average impact resistance of approximately 2 ft. lb. Average specific gravity was 1.75.

Duralon

A new furane basic resin, Duralon, is announced by the United States Stoneware Co., Akron, Ohio. Duralon resin is said to have the lowest water absorption of any organic resin, to be insoluble after activation in any solvent or combination of solvents, to possess high electrical resistivity, stability in storage and handling and ease of workability.

Duralon resin, in its pure form, is a heavy viscous liquid, dark maroon in color. When catalysts and low heat are applied the resin becomes an extremely hard, dense black substance. A variety of physical, chemical and electrical properties can be developed in the base resin by various fillers and plasticizers. In certain stages Duralon is readily machined by drilling, milling, turning, sanding, grinding, etc.

Preliminary studies indicate Duralon has definite molding possibilities but that it is of immediate importance as an impregnant, a laminating and bonding agent or as a protective coating material. As a coating Duralon is soft and flexible before heat is applied. The resin is thermoplastic up to a point at which it becomes increasingly thermosetting. It is particularly effective as a coating for armature wire since Duralon shows unusual resistance to arc flashover and to tracking. Other uses, suggested by the background of several years of research, are as a casting resin, surface bonding agent (wood, plywood, glass fiber, cloth, paper, etc.), a particle bonding agent (friction or anti-friction materials, abrasives, powdered metals, etc.), as an impregnant (plywood, masonite, asbestos, glass fiber, paper or other porous materials), as a modifying agent for oils, paints and varnishes to increase oil, water and solvent resistance, to toughen films and improve adhesive and drying qualities. It may also be used as a wetting, plasticizing or tackifying agent for synthetic rubber compounds or as a modifying agent for other synthetic resins.

The United States Stoneware Company announces the new basic resin is available for limited commercial and experimental use.

DRILLING AND TAPPING PLASTICS MATERIALS

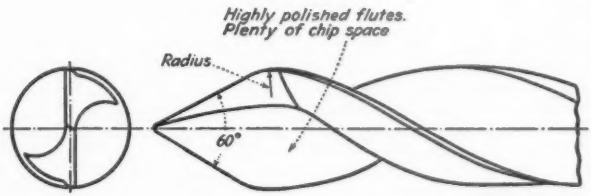
The first thing to remember when machining operations in plastics is that molded plastics is not a precision industry. The materials vary from batch to batch and with every type or percentage of filler used. The "factor of ignorance," as engineers call it, must always be considered in drilling and tapping plastics materials.

"Finishing" is a broad term in the plastics industry used to include operations after or supplementary to the actual molding or fabricating process. Normally the molded articles are rough finished, i. e., the flash from the parting line and the openings in the pieces is ground off or removed in some other way. Then drilling and tapping, together with other necessary machining operations, are performed, after which final finishing operations such as buffing or polishing are done.

Most molded parts, cast resins and laminates can be machined, some quite readily. When drilling is required, as for example to form small holes at an angle in a molded material, the nature of the material must be considered. The cast resins (chiefly phenolics) present little difficulty. But when the molded phenolics and ureas contain abrasive fillers, as they frequently do, care must be exercised to determine the highest speed at which the machine may be operated without overheating the tool or the material. Drills cutting abrasive molding compounds dull easily and at improper speeds and feeds tools will even burn. Many molded surfaces become gummy when heated, causing a film of burned resin to build up, tending to cause sticking, crazing or even cracking of the work piece.

For drilling small holes, up to ¼", in most molded compounds, drills designed for plastics work are recommended. Such drills are available in 60° to 90° included angle points with polished flutes, which are wider than the standard machine drill and have a slow helix. Tests have indicated that a 60° included angle is desirable for sections up to ⅛" thick and a 90° point for thicker sections. A slow helix works best for through holes and a fast helix works best on blind holes. A 15° lip clearance is provided.

For drilling molded phenolics (the commonest used material) a drill ground to 70°-90° included angle has proven very satisfactory. The pointing of drills increases the power consumption. However, it diminishes the feeding pressure which minimizes the chipping around the holes. Since most molded phenolic drilling involves very small holes, the increase in power is not critical. The spiral on the front of the cutting edge of the lip is ground away slightly. This is a precaution to prevent the cutting edge of the drill from catching and pulling through at the end of the operation. The back of the cutting lip is ground away to about ⅛" wide. This is done for two reasons: (1) it diminishes the friction between the drill and the piece; and (2)



Courtesy Bakelite Corporation

Fig. 1 — A general drill design for thin sections of molded plastics. This drill has 60° included angle points, polished flutes wider than the standard drill and a slow helix. This design is efficient for cuts up to 3/16" deep.

it provides greater chip clearance during drilling.

An air blast concentrated on the drill during operation prolongs drill life considerably since the air clears away the chips, minimizes the friction and acts as a cooling agent.

Drill speeds in rpm decrease as the drill diameters increase, but the peripheral speeds for various phenolics range from 100 to 250 fpm. Comparatively heavy feeds should be used to insure that chips work out and prevent the drills from burning up. In drilling deep holes the drill should be raised frequently to clear out the chips and prevent the drill from overheating.

The above applies also to the molded ureas.

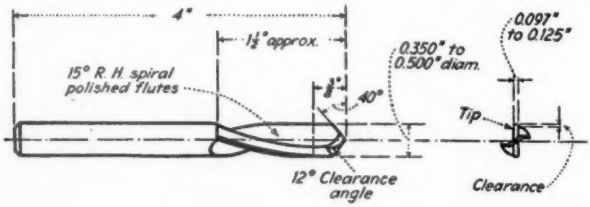
When tapping molded phenolic materials that contain abrasives it is good practice to use high speed nitrated and chrome plated taps having three flutes rather than the four commonly used. A negative rake of about 5° on the front face of the land will, in some cases, prevent binding of taps in the hole when they are backed out.

It is also recommended to use machine taps .002" to .005" oversize as these taps will produce more parts per tap. For example, a 6/32" screw diameter is .138". The standard tap diameters are minimum .1395" to maximum .1415". So if a tap should be to the minimum dimension, it will wear down to .138" in approximately 400 holes, making the hole too tight. If an oversized .005" tap is used, it is possible to produce at least 1200 holes per tap. From 65% to 75% of thread should be used.

Peripheral speeds for tapping phenolic molding materials are from 50 to 80 fpm.

It is important to countersink the holes larger than the diameter of the tap to prevent chipping around the threaded hole.

Air blasts concentrated on the tap operated by the stroke of the tapping head will help to clear the chips and act as a cooling agent, minimizing friction and overheating, which prolongs the life of the tap and results in greater production per tap.



Courtesy Bakelite Corporation

Fig. 2 — A general drill design for laminated plastics. The included angle points are 40°; a 12° clearance angle is incorporated; flutes are polished. The drill size should be slightly oversize.

For drilling cellulose acetate, polystyrene and acrylics, a slow drill speed is desirable to minimize the tendency to heat up. Drill speeds of 100 to 300 fpm have been used depending on the equipment, type of feed, size and depth of hole and other factors. In general, higher speeds are used when the drill press is equipped with mechanical feed and small, shallow holes are being drilled. An average speed of 120 fpm is good for well lubricated equipment. The rate of feed should be decreased as the depth of the hole increases. It is good practice to withdraw the drill every quarter inch to allow the chips to be cleared. A small piece of plastics material or wood touched to the drill as it is withdrawn speeds chip removal. Even better, the touch of an oiled brush both removes chips and lubricates.

On the break-through these plastics show a tendency to chip if cold, or burr or flare if hot. This can be avoided by backing up the material or substantially reducing the rate of feed. A heavy spring, mounted on the depth gage of hand fed drill presses so that the spring is slightly compressed just before the break-through, is helpful, since it automatically slows up the feed at this critical point.

This group of materials ordinarily

utilizes a coolant. Water or an air jet may be used but for holes over ⅛" diameter soap usually is used. For cellulose acetate sheets a thin, warm soap solution has been very satisfactory. For drilling shallow holes the soap may be rubbed on the drill. For deep holes, the work should be flooded with the coolant.

A spiral flat faced drill, produced by many drill manufacturers, is designed for drilling holes in thin sheets of cellulose acetate and similarly machined materials. Hollow end mills (trepanning tools) mounted on a vertical drill press are good for drilling large holes in thin sheeting. They produce clean, accurate holes and show no tendency to chip on the break-through.

Flycutters are useful for cutting holes greater than 1" in diameter in heavy sheeting or many other molded or laminated compounds. These tools should be run at fairly low speeds. Coolants are recommended.

For tapping cellulose acetate, polystyrene and acrylics, standard thread forms may be used with good results. U. S. Standard, Whitworth Standard and Acme are generally satisfactory. Short "V" threads are to be avoided because of the ease with which the apex fractures. Coarse pitch threads are preferred because of their added strength.

Standard taps and dies may be used but modified high speed tools give best results. For long production runs chrome plated taps with highly polished flutes wear best and facilitate the removal of chips. Again, as with the molded phenolics, three fluted taps are preferred.

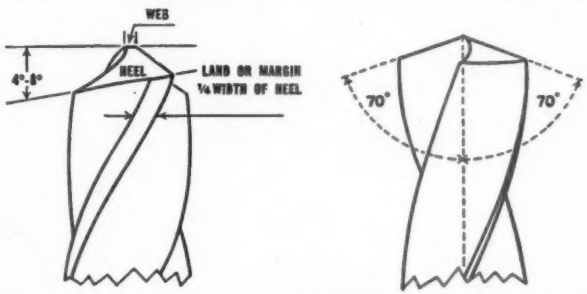
In hand tapping holes of ⅛" or less, a coolant need not be used. On larger holes, a mild soap coolant is desirable. For machine tapping, the work should be flooded with the soap coolant. Taps should be backed out frequently to avoid jamming.

An allowance should be made when tapping to fit a metal nut or bolt, to allow for the difference in the coefficients of thermal expansion of the two materials. A slight increase over the normal metal clearance is usually sufficient.

Parts molded from the vinylite resins can be drilled in much the same manner as other molded compounds. Standard drills and the usual feeds are used. For deep holes—whose depth is more than twice the drill diameter—drills with extra large flutes are recommended. For drilling small holes speeds of 4000 to 6000 rpm are recommended. The rule of thumb is a speed as high as possible so that the drill will be in the work the shortest practical time.

Standard machine and pipe tapping and threading dies can be used satisfactorily on parts molded of the styrene and vinylite resins. The traverse should be single and uniformly continuous; the speed should be moderate to slow, limited by the rate of heat development.

Drilling and tapping operations usually can be speeded by the use of multiple drilling and tapping machines utilizing a suitable drill jig.



Courtesy E. I. duPont de Nemours & Co., Inc.

Fig. 3 — These drill design features are efficient for the cellulose (acetate), the acrylate and methacrylate resins and others with the machining characteristics of soft metals. The modified drill has a flute angle of 17°, lip angle of 70°, lip clearance 4° to 8°, polished lands ¼ the width of the heel and polished land heels. The thin web and the polished flutes facilitate chip removal.

CONTOUR CAVITY FORGING OF LARGE CALIBER SHELL

John C. Norman
GENERAL MANAGER
Porter-Blairsville Co.

A new forging technique, the "contour cavity" method developed in the Porter-Blairsville Co., subsidiary of the H. K. Porter Company, Inc. of Pittsburgh, Pa., for the forging of large caliber shell for the Navy, has proven to have important production advantages. A saving of 13% of the steel used as compared to previous practice is one major advantage. Another is the overall cost of making shell by the new process. The saving was passed along to the Navy in the form of a voluntary reduction in price.

The previous method of producing the shell utilized straight cavity forgings. The operations were: upsetting and piercing in one pass of the press, using a straight punch; drawing in the draw bench, using five rings; machining to

Fig. 1 — Heated billet emerges from billet heating furnace at Porter-Blairsville Co.

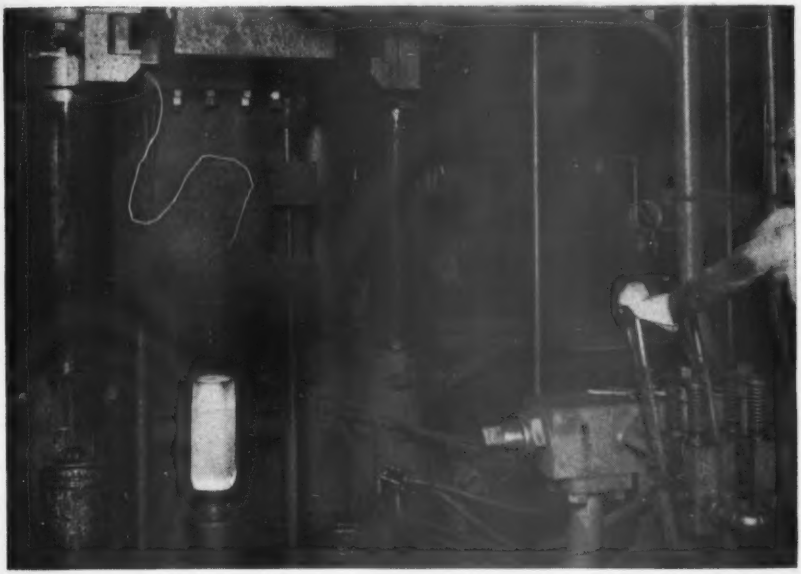


Fig. 2 — Billet piercing operation. Die holder is shown above billet after piercing.

Fig. 3 — Slug in draw bench basket, where it is drawn using five rings.

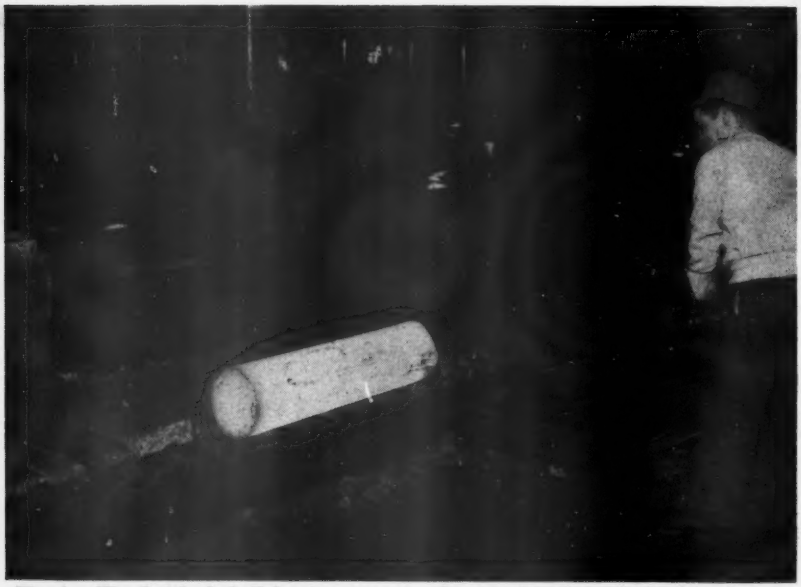


Fig. 4 — The finished shell forging emerges after coming through the draw bench.

Fig. 5 — Forging shown in first rough turn operation.

Fig. 6 — The forging stands under nosing die after nosing has been completed.

give the proper contour for the nosing operation.

This method required considerable metal removal by machining the outside of the forging. It differed from the contour method which removes metal from the interior of the forging with little waste of metal.

In the new forging method a shaped punch is used to produce a "contoured cavity". The name exactly describes the operation; the interior cavity is flared out in size from the closed end to the open end of the forging.

Due to the fact that the contoured cavity is of larger diameter than the previously formed straight cavity, larger punches and mandrels are used, which give better rigidity and wear in operation. This tends to produce more concentric forgings and give better tool life. Also, because of the larger diameter mandrel used in the draw bench, there is less tendency for the base to punch through in drawing than with the smaller mandrel used for straight cavity forging.

Since the required taper has, to a large extent, been produced in the forging process, much less machining is required. In this one feature, the contoured type forging has reduced the metal required per unit by approximately 13%, a very valuable saving of critical shell steel. Over nearly two-thirds of the length of the shell steel, the amount of metal to be turned from the outside diameter, has been reduced by almost an inch.

This reduction has increased the capacity of the rough turning lathes by 35%. Due to the lighter cuts required the life of the carbide cutting tools has been increased by a greater percentage.

TAP DRILL SIZES AND TAPPING SPEEDS

C. W. Hinman
Designing Engineer

Before beginning the subject of tapping fixtures as used in modern interchangeable manufacture, we should consider some of the causes of the many variables found in charts that are supposed to show the tap drill sizes for different materials. A careful study of the subject has revealed that these charts offer only tentative information and cannot be expected to meet every practical requirement. The following conditions show a few of the many obstacles encountered in an attempt to compile a reliable chart for practical tapping operations.

1. Variations in tap sizes:
   A—Commercial tolerances of plus 0.0025″ diameters
   B—Worn taps
   C—New taps
2. Variations in the size of holes produced by drills depend upon:
   A—Method of grinding the drill
   B—Material to be drilled
   C—The lubricant used, if any
   D—The speed and feed of drilling
3. Allowable tolerances in standard drill sizes:
   Smallest drill (No. 80) minus 0.0005″ plus 0.0015″
   Largest drill (No. Z) minus 0.000″ plus 0.0015″
4. Machine variations:
   A—Worn drill press spindle
   B—Worn tapping chucks
   C—Spindle not perpendicular to work
5. Materials to be tapped:
   Kind, condition and thickness, through or bottomed holes, percentage of thread desired. Most materials have a tendency to "spin up" when being tapped; this important factor must be considered before determining tap drill sizes. Soft materials may close in after tapping and hard materials do not. The only practical method to determine these variables is by an actual try-out.

Other conditions depend upon the relation of the tap diameter to the percentage of thread to be cut, the number of threads per linear inch, shape of the tap flutes, the chamfer on its point, and the type of lubrication used. Large taps may use tap hole diameters that give only 50% of a full thread in deep holes. Average tap sizes may require a 66% or 75% thread. In thin, nonmetallic materials a full thread is often tapped.

A number of recent tension tests have shown that any steel nut of only half a full thread which is purposely overtightened against a block through which the bolt protrudes, will strip the bolt threads first rather than fracture the nut, strip its threads, or stretch the bolt proper. These tests indicate that a 75% thread is of ample strength in ordinary practice. It has been proved that such a thread takes only 5% more power to cut than a 50% thread and permits therefore easy and economical tapping.

A 100% or full thread is difficult to produce in depths greater than the tap diameter. Tests have shown repeatedly that it is only 5% stronger than a 75% thread and it consumes three times more power in cutting. Full threads can be used in most nonmetallic materials that do not show a tendency to adhere too tightly to the tap. A general rule for tapping metals is to use a full thread to depths *less* than one half of the tap diameter, a 75% thread in depths up to twice the tap diameter, and a 50% thread for deeper holes.

Soft tough metals, such as Norway iron, copper, drawn aluminum and magnesium, should have about 3% larger tap hole diameters than the harder, crys-

talline, cast metals. This is because the metal closes in slightly on the tap while it is cutting soft materials and this tendency increases as the tap becomes dulled. If the hole is too small, the threads will be torn and their effective depth reduced in comparison to what it would be if the tap hole were of suitable diameter.

Formulas for Tapping

For determining T, or the hole diameter for tapping a 75% thread of US Form, which includes the ASME and SAE specifications, when D is the outside diameter of the tap, and N the number of threads per linear inch, then:

$$T = D - \left(\frac{0.9743}{N}\right)$$

Some manufacturers make a distinction between the diameters of tap drills used for hand and machine tapping. For machine tapping the hole should be about 2% larger in diameter than when tapping by hand. This is a safeguard because in machine tapping the speed is constant and gives less chance for chip clearance and, besides, the speed is many times faster than when tapping by hand.

The single depth S for a US Form thread is $S = \left(\frac{0.65000}{N}\right)$

The percentage P of a full thread is

$$P = \left(\frac{N\ (D\text{-}T)}{1.3}\right)$$

Tap hole diameters for US Form threads can be determined quickly by using a formula easy to remember: *Outside diameter of the tap minus the distance from thread to thread.* Diameters of new taps are from 0.002″ to 0.005″ greater than the nominal size. Before using this formula find the diameter of the tap with a micrometer. The distance from thread to thread is the lead, or $\frac{1.000}{N}$. For example: What is the tap hole diameter for a 1″ tap having 8 threads per inch? Solution: 1.003″ minus 0.125″ = 0.878″, and the nearest commercial drill size is ⅞″ diameter. This formula gives a 75% thread which is standard practice.

Speeds and Lubricants

The correct rpm of the tap for threading different materials and the use of proper lubricants are even more important in tapping than in drilling operations. Taps that run too fast will wear and become dulled more rapidly than overspeeded drills. Tap breakage can be materially reduced by using proper speeds and lubricants. A high-grade compound of screw cutting oil is used for threading ferrous metals; lighter lubricants, such as kerosene, are used for rolled aluminum, magnesium, zinc, brass and other soft metals. Lubricants recommended in their order of efficiency for tapping ferrous metals are: lard oil, sperm oil, mixture of 10% graphite and 90% tallow, soap and water emulsion, mineral oils and machine oil, the latter being a very poor lubricant for threading any kind of metal. If in doubt about the right lubricant for a particular job, consult your oil suppliers. They are in touch with many other manufacturers' problems and can give first-hand information.

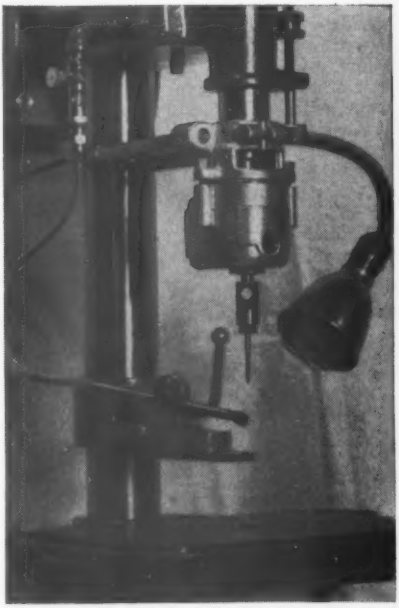


Fig. 167—Tapping chuck driven by vertical spindle machine. Note work holddown or stripper fixture adjustably mounted on vertical column and brush for feeding coolant or lubricant to tap. Stop-nut controls descent of tap and friction clutch drive protects against tap breakage.

It would be impossible to give detailed tables here for tapping speeds because they vary for different pitches of threads and materials and decrease considerably in feet per minute as the tap diameters increase. However, some general recommendations can be made that will serve the same purpose as an elaborate table.

High-speed steel threading tools, of less than ¼" diameter, should not be driven to exceed 50 fpm for cutting ferrous metals. The feet per minute for diameters less than ¼" are: 140 for drawn brass; 50 for cast iron; 25 for tool steel; and 125 for cast brass. These figures should be reduced 20% for diameters greater than ¼" and up to 1", and reduced another 20% for diameters greater than 1" and up to 2", with a further reduction of 20% for diameters greater than 2". These cutting speeds are for annealed stock. If heat treated material is to be threaded, all cutting speeds should be decreased 25%. Every new threading job becomes more or less a law unto itself. The speeds given here will start the job and changes can be made after ascertaining how the tools stand up. Make a record in a card file for each job for something to rely upon when the same job comes up again.

As with drills, the circumferential travel C, in feet per minute of a tap, is the number of feet it would travel if rolled on its OD. $C = D \times \text{rpm} \times 0.262$, in which 0.262 is a constant. By transposing terms: $\text{rpm} = \dfrac{C}{D \times 0.262}$.

Example: If a US ½" —13 hole is to be tapped ¾" deep in machinery steel, the tap hole diameter is: $T = D - \left(\dfrac{.9743}{N}\right)$ or 0.503" minus $\dfrac{0.9743}{13}$ or 0.428", and the nearest commercial drill is of 27/64" diameter. The circumferential travel of a ½" tap would be 40 feet per minute in cutting steel and the tapping speed would be: $\text{rpm} = \dfrac{40}{0.503 \times 0.262} = 303$.

Most tapping chucks and machines reverse the tap and withdraw it from the work at twice the speed it entered.

Improvements in threading operations have led the vanguard of tooling progress for more than ten years. The slip-shod tapping methods used in most shops just a few years ago are happily on their way out. Once it was thought that any kind of tapping chuck would do if it could hold a tap and be reversed somehow to back it out. Even speed lathes were converted into horizontal tapping machines by using friction disks on the head-stock spindle driven by crossed and open belts for tapping "in" and "out."

Some years ago it was discovered that when taps and dies were not held in rigid alignment with the work it caused incorrect threading, dulled and broken taps, and that the tools became scrap prematurely. Precision tapping and threading then appeared in the picture but it was soon found that real precision could not be attained without securing the tools in chucks and machines as rigidly aligned as when drilling, boring, or doing other precision operations.

The next step in progress was to eliminate the human variables. Feeding a tap by hand, until the threads "caught" in the work, and either cut a thread or roughly reamed the hole, was replaced by a piston control operated by compressed air, controlled by a foot treadle. Air control was utilized for tapping both "in" and "out." The idea was then incorporated in new types of tapping machines which were redesigned from the floor up. Another improvement then suggested itself: pieces of work could also be positioned from a hopper and chute and properly aligned for tapping by compressed air fixtures. Built-in air control is only one of the many improvements in design which have been incorporated in high-speed precision tapping machines.

Many small tapping operations are performed on universal equipment similar to that shown in Fig. 167. The motors used are from ¼ to ½ hp. The tap is held in a collet chuck, and "brush lubrication" is furnished through an attached pipe and hose connection. The brush wipes oil on the tap when it descends to tap a hole in work held by a fixture on the table. A stripper plate that is adjustable in height to suit the work is shown just under the brush. A stop nut can be adjusted to control the descent of the tap. Speeds range from 275 rpm for tapping "in", to 2100 rpm for the speed "out." Sensitive friction clutches prevent tap breakage and ensure long runs of work before changing an old tap for a new one.

Better, Longer-Life Tools

WITH MEEHANITE

YES, cutting tools are weapons, too . . . so treat 'em right. If they can perform better and longer, then America's machines can deliver on time the goods that war's climax demands.

Cutting tools *can* perform better and last longer — even in the hands of less experienced workers — when they are Cooper-Bessemer-made of Meehanite, tipped with cemented carbide. Meehanite tool shanks, forming tools, milling cutters and many special purpose tools give you numerous unique advantages — greater vibration damping capacity, less loading in operation, easier and less machining before tipping, and lower cost.

Hundreds of shops are using these Cooper-Bessemer tools today. They are available promptly, ideal for any plant equipped to tip its own tools.

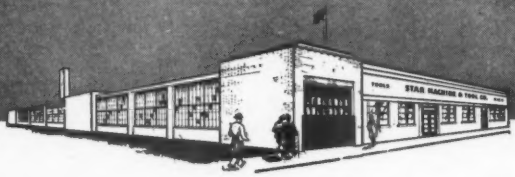
Samples furnished upon request, so you can judge their value by performance in your own plant. Ask also for our Bulletin 53-T-2.

THE Cooper-Bessemer CORPORATION

DEPT. J.. MOUNT VERNON. OHIO

STAR

CAN SOLVE YOUR TOOLING PROBLEMS



We, like every contract tool and die shop, are constantly urged by our customers—and prospective customers—to take just "this one more job." It is hard for us to say "No." Being anxious to give every service we possibly can, we sometimes run into some overloading of critical machines.

On the other hand, the most economical shop work routing, and the most efficient distribution of skilled man-hours, often gives us some planing hours, a jig borer operator's time, jig or fixture capacity, die making or gage making time. We like to use these free hours—of both machines and workmen—to the best mutual advantage.

It is entirely possible we can help on your most urgent or vexing job. We'll do our best for you.

Designers and Builders

)F DIES • JIGS • FIXTURES • GAGES • SPECIAL
IACHINERY • JIG BORING • PLANER EQUIPMENT

STAR MACHINE & TOOL COMPANY

9320 Woodland Ave • Cleveland 4, Ohio

PROGRESS ON PARADE

GRINDING WHEEL SPECIFICATION LIST. A great many of the grinding wheels that are now being used to grind carbide tipped tools are mounted on steel plates and because of this unusual mounting many users have difficulty determining how to specify wheels as used on different makes of machinery. There is a wide range of wheel sizes as well as various hole arrangements on the steel plates for the several makes of grinding machines. It is for this reason that the WALTHAM GRINDING WHEEL CO. has compiled a list of complete specifications of all wheels and

mounting plates for the well known grinding machines. They believe that the general distribution of this information to users of plate mounted wheels will be of great assistance to purchasing, stock control and production departments, and will simplify the problem for all grinding wheel manufacturers. Copies of this list, in sufficient quantity for use throughout a plant, can be obtained and a list of the standard sizes of straight wheels commonly used in sharpening carbide cutting tools is also available Send your request to the Waltham Grinding Wheel Co., 19 Emery St., Waltham, Mass. **514-K**

"MASTER" COLLET CHUCKS. United Industries have recently announced a new line of "Master" Collet Chucks with larger capacities than heretofore obtainable. The collet is of special design, actuated by hardened steel balls, producing a powerful gripping action which insures against all possibility of stock slippage. The hand lever engages or releases the collet without stopping the work head. They are made in sizes for any size or make of machine and are adaptable to any

operation requiring the use of a chuck—on lathes, screw machines and grinders. "Master" Collet Chucks are precision built with all working parts hardened and ground. They are available in four standard sizes—¾", 1", 1¾" and 2¾" round—and special larger sizes may be had. Write UNITED INDUSTRIES, 8348 Second Blvd., Detroit 2, Mich., for further details. **127-K**

NUPLA PLASTIC HAMMERS. The Nupla line of plastic hammers, made of a special semi-soft plastic, has been introduced by the New Plastic Corporation of Los Angeles. They will not mar, batter or cut into the metal upon which they are used and will prevent

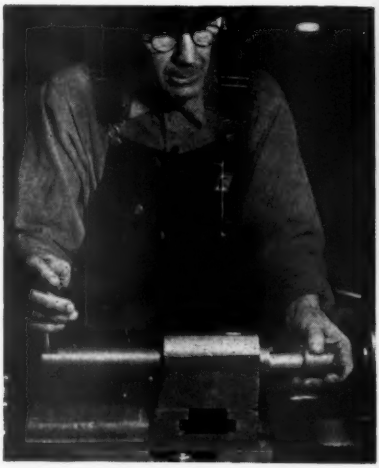
"pile up" of the material. They are recommended for metal forming in dural, aluminum, brass, bronze, etc., as well as for machine shop work, particularly on ground finishes and other fine surfaces. They are also adapted for assembly work and for the tool room, in

PROGRESS ON PARTS

pressing inserts into molds and performing related tool and die work and similar operations. Nupla plastic hammers are available in seven sizes and seven weights ranging from 5 oz. to 2 lbs. and in two hardness grades—"A" Cryst-O-Flex for general machine work and "B" Cryst-O-Flex for metal forming. As the striking surfaces become worn a new surface is obtained by simply cutting a small slice off the head with a band saw and polishing the edges on a sander. NEW PLASTIC CORPORATION, 1017 North Sycamore Ave., Los Angeles, Calif., will send additional data on request. **988-K**

TOOLMAKERS DIVIDERS. The replaceable alloy steel needle points used in these new toolmakers dividers eliminate regrinding. Dulled points are easily replaced with the aid of pliers, hence the dividers retain their original length and can give virtually unlimited service. The points are the same as those used in other tools produced by the manufacturer and are available from dealers or direct. The spring is unusually thick and stiff and has sufficient tension to prevent wobble and torsion even when the legs are spread to their maximum. The spool is tapered to automatically compensate for wear. Together, the stiff spring and tapered spool insure rigidity and accuracy. The legs are round, machined from solid steel and highly polished. The screw and adjusting nut are accurately threaded and the grip is provided with a precision knurl. Manufactured by NORK PRODUCTS CO., 5897 South Main St., Los Angeles 3, Calif. **989-K**

ENGINE-LATHE TOOL HOLDER. The Lane-Wells Universal Tool Holder, developed by the Lane-Wells Co., cuts tool changing time to approximately five seconds and thus greatly reduces operating time. The device consists of a tool post which can be fitted on to any engine lathe carriage compound rest. The detachable heads fit a cylindrical member clamped in the tool post. Standard high-speed tool bits ground for boring, turning, threading, facing or forming are held in the heads and each bit remains in place on its head. Any number of operations are possible on an ordinary engine lathe equipped with the Universal Tool Holder and a supply of detachable heads. The one tool holder will serve for either turning or boring operations. The four sizes of the device fit all standard makes of engine lathes, from 10" to 24". LANE-WELLS CO., Los Angeles, Calif., will send full particulars. **356-K**



NEW STYLES OF STELLITE-TIPPED TOOLS. Two new styles of tipped tools, especially designed for machining steel, have been announced by HAYNES STELLITE COMPANY, a Unit of Union Carbide and Carbon Corporation, Kokomo, Indiana. The new tools, designated as Style P and Style Q, consist of a cutting tip of Stellite 98M2 cobalt-base alloy brazed or butt-welded to a tough steel shank, with proper clearance and lead angles ground for turning steel. These and other Stellite tipped tools are recommended for applications employing tools that have a large cross section or tools that are bent or offset, or for tool holders which make the use of solid tool bits impractical. Style P is a right-hand tool;

Remember the hump in the hairpin?

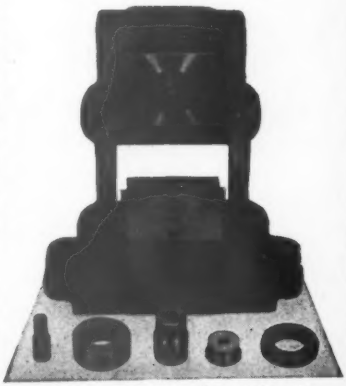
Here's Another improvement that is rapidly replacing previous methods

HOVIS METHOD OF MAKING WASHERS

You will recall how the man who put the hump in the hairpin created a national sensation almost overnight. It kept the hairpin from falling out of milady's hair, and women demanded it. Hovis Universal Master Washer Dies are another outstanding improvement. They are revolutionizing the method of making washers by saving the materials and cost of making a new die for each size and type of washer. You merely invest in moderately priced washer dies to fit your needs, and then FIVE SMALL INTERCHANGEABLE PARTS are all that is necessary to buy in order to make any size washer. No process engineering, tool designing, tool making or tool tryout.

When planning your postwar products, remember that a number of Hovis Master Washer Dies have been in continuous use for more than 4 years, and the Master Dies themselves do not become obsolete. A new set of interchangeable parts are all that you need for your new products.

Write for Literature

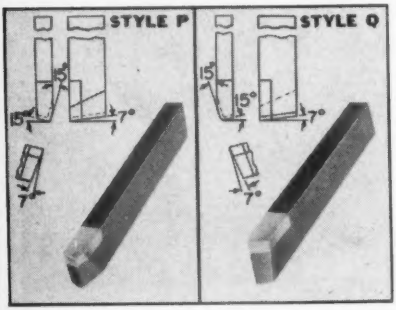


Made in 4 sizes: ¾"—1½"—2½"—4".

HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD — **Suburb of Detroit Phone: Centerline 1575** — **VAN DYKE, MICHIGAN**

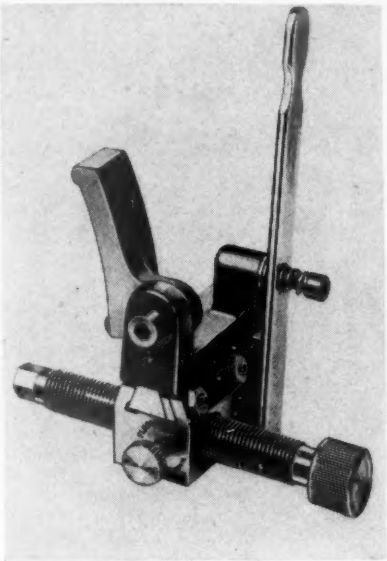
Style Q is a left-hand tool. They are ground with a 15° end cutting-edge angle, a 15° side cutting-edge angle, a 7° end relief angle and a 7° side relief angle. These tools are furnished with flat tops thus enabling users to grind their own side rake



angle for each particular job. Styles P and Q are available in five sizes and are also made with Stellite Star J-Metal tips. You can obtain further details by writing the Haynes Stellite Company. **313-K**

ANGLE TOOL ATTACHMENTS. Castings can now be broken loose from the mold quickly and easily with Invincible Angle Tool Attachments. On heavy volume production, much time is lost in freeing these castings by hand. Invincible Attachments are designed to save manhours by putting power into this operation. The Attachments are used in conjunction with a low-speed portable drill of approximately 500 rpm, or with any comparable low speed driving unit. Adapters to fit the molded pieces can be made interchangeable on the two types of Invincible Angle Tool Attachment.. The types include 45° and 90° Angle Tools. These tools are now made in two sizes and larger sizes are planned for production as the demand arises. Invincible Attachments can be be used on die cast parts as well as plastics molded parts. Full details and catalog are available from INVINCIBLE TOOL CO., 116 Empire Building, Pittsburgh 22, Pa. **979-K**

THE FLORIAN "JIFFY" GRINDING WHEEL DRESSER for mounting on toolroom surface grinders has been announced recently by the AMERICAN STANDARD CO., Southington, Conn. This new tool, manufactured by the Florian Mfg. Company, Plantsville, Conn., becomes an integral part of the grinder on which it is mounted and, regardless of the



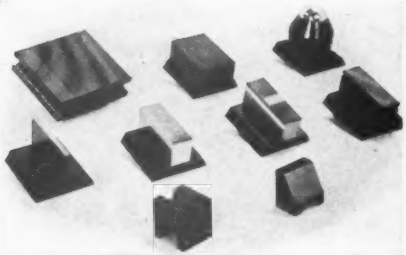
relative position of the wheel to the table, is always ready for wheel dressing. With a "Jiffy" it is not necessary to disturb the work set-up in order to dress the wheel as occasion demands. Adjustable to dress absolutely true, it is simple to mount and fits all standard surface grinders. Bulletin No. 602-J containing descriptive literature and price is available on request. **985-K**

SMALL HEAT TREATING FURNACES. The small electric muffle furnaces manufactured by the Cooley Electric Manufacturing Corporation have proved to be fast and economical for heat treating small parts; drawing or tempering small lot runs; normalizing or anneal-

AN INVITATION TO PRODUCTION MEN with INSPECTION PROBLEMS

Many shops, confronted with unfamiliar types of work, often find it difficult to speed up and simplify inspection because of a lack of the right instruments and attachments for proper and efficient handling of inspection. Our engineers have rendered valuable aid in solving many of these problems.

The SCHERR COMPARITOL, which is the basic instrument for a wide range of inspection, may be readily adapted to measuring work to an accuracy of 1/10,000" or closer. Shown here is the COMPARITOL equipped with a special fixture for checking two dimensions, one against a shoulder, on a precision ground shaft. With this fixture, the operator is enabled by simply moving the work, to inspect twice as fast as he could without this work-supporting attachment.



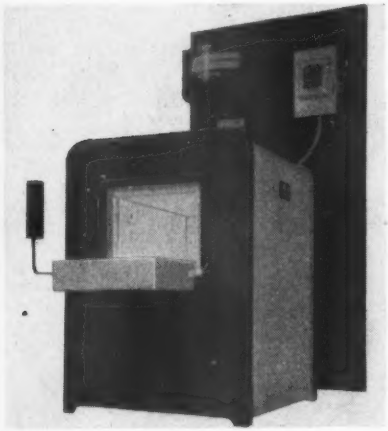
Shown here are typical anvils of various shapes and sizes for use with the Scherr Comparitol to help solve inspection problems involving all sorts of work which can be inspected on this fast, accurate measuring instrument.

Please write today for your copy of our literature showing the Scherr Comparitol. This measuring instrument belongs in every metal working plant doing accurate work.

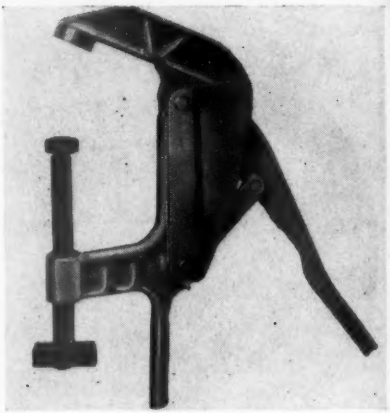
Write, wire or phone Canal 6-3512 for full information.

GEORGE SCHERR CO.
INCORPORATED
128-B LAFAYETTE STREET · NEW YORK 13, N. Y.

ing; pre-heating for subsequent high-speed hardening and for emergency repair orders where one or two parts must be heat treated in a short time. The outer shell of the furnace is of heavy gage sheet steel and the frames are secured by through rods. Since the elements are of the embedded type, the element wire is protected against atmospheric attack. Four interlocking, rectangular elements form the interior of the chamber and replacement is a simple matter. Although the furnaces can be either automatically or hand controlled, automatic control is recommended for more even heat treatment and better results. The electric heat treating furnace is offered in two sizes: Type MH-3, with a chamber capacity 8" wide, 6" high, by 14" deep and maximum power consumption of 3400 watts and Type MH-4, which has a chamber capacity of 10" wide by 6" high by 18" deep and maximum consumption of 4800 watts. Operating temperatures are 1750° F for continuous operation and 1850° F for intermittent operation. Write COOLEY ELECTRIC MANUFACTURING CORP., 32 South Shelby St., Indianapolis 7, Ind., for complete data. **587-K**



NEW KNU-VISE "C" CLAMP. The newly improved "C" Clamp, manufactured by KNU-VISE, INCORPORATED, now incorporates greater strength, added throat capacity, and a worth-while reduction in weight compared with former "C" clamp models. The use of forgings gives the clamp its added strength and allowed streamlined redesigning of the clamp, thus permitting a saving in weight of 17%, an important factor to be considered where the clamp is being handled constantly. The increased throat capacity enables this Model 505 to accommodate a wide range of work. A wing nut replaces the knurled head on the spindle which adjusts the gap for the required thickness of the work. Once adjusted, the clamp remains at that exact setting and the necessity for screwing and unscrewing between subsequent clampings is eliminated. For descriptive literature on the Model 505 "C" Clamp, writes Knu-Vise, Incorporated, 1330 Plum St., Detroit 16, Mich. **649-K**



MARVEL GRINDING SHIELD. The new model Marvel Grinder Shield which provides properly directed light, and protection for the face and eyes from flying particles has a completely redesigned frame molded from a

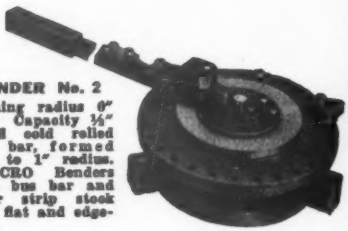
PRECISION CENTERED EYE BENDING with DI-ACRO BENDERS

A Centered EYE in 1 Operation

The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at a high rate of production. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

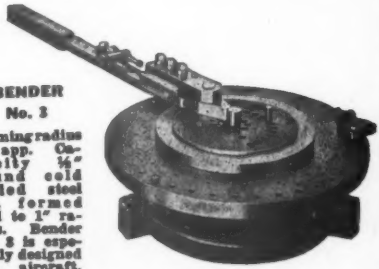
BENDER No. 1

Forming radius 2" app. Capacity 7/32" round cold rolled steel bar or equivalent. All DI-ACRO Benders have two-way action, right or left hand mounting and reversible forming nose.



BENDER No. 2

Forming radius 0" app. Capacity ¼" round cold rolled steel bar, formed cold to 1" radius. DI-ACRO Benders form bus bar and other strip stock both flat and edgewise.



BENDER No. 3

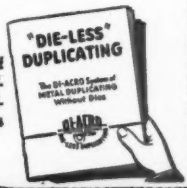
Forming radius 0" app. Capacity ¼" round cold rolled steel bar, formed cold to 1" radius. Bender No. 3 is especially designed for aircraft, marine and other large radius bending.

DI-ACRO precision bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

Send for Catalog

"DIE-LESS DUPLICATING"

showing many kinds of "DIE-LESS DUPLICATING" produced with DI-ACRO Benders, Brakes and Shears.



DI-ACRO PRECISION MACHINERY DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

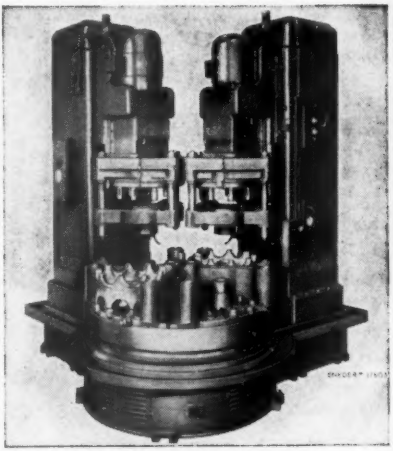
315 8th Ave. S.
Minneapolis 15, Minn.

high impact resisting plastic material. Electrical parts are in a completely insulated chamber and mounted on an adjustable bracket. The light is focused directly on the work, assuring more rapid and accurate grinding. The window is of non-shatterable glass and the bulbs, of the bayonet type, are vibration resistant and are set flush with the frame. The Marvel Grinder Shield is manufactured by THE BOYER-CAMPBELL COMPANY, 6540 Antoine St., Detroit, Mich., who will send full particulars on request. **67-K**

PERSONALIZED GAGE BLOCKS. A personalized set of chromium plated gage blocks for toolmakers who want their own individual set of standards for checking purposes has been announced by the DEARBORN GAGE COMPANY, 22038 Beech St., Dearborn, Mich. This gage block set is the first tool makers' set to be offered with chromium plated gaging surfaces for longer wear. Each set consists of six

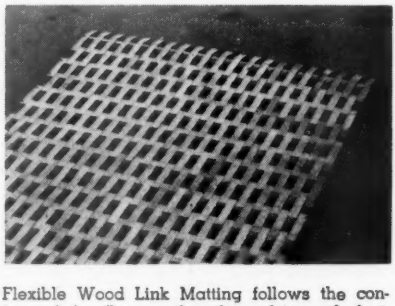
blocks in the following sizes, .0625, .125, .250, .375, .500 and 1". The set comes in a hand-rubbed walnut case. The company will send more information on request. **139-K**

THIS SPECIAL PURPOSE MACHINE is for reaming leg holes in aircraft crankcase sections and consists of two Snyder 10 V 18 standard drilling machine column assemblies mounted on a special base. Four fixtures are mounted upon a 60" diameter turntable which is mechanically indexed through a Geneva mechanism. The work-cycle is semi-automatic. When the starter button is pressed, the table indexes and the reamer heads automatically feed the tools into the work. The table indexes again and at the next station the first nine holes are completed. The third index brings the part to the right-hand loading station and then the part is reversed, reloaded in the left-hand loading station and again indexed through both work stations

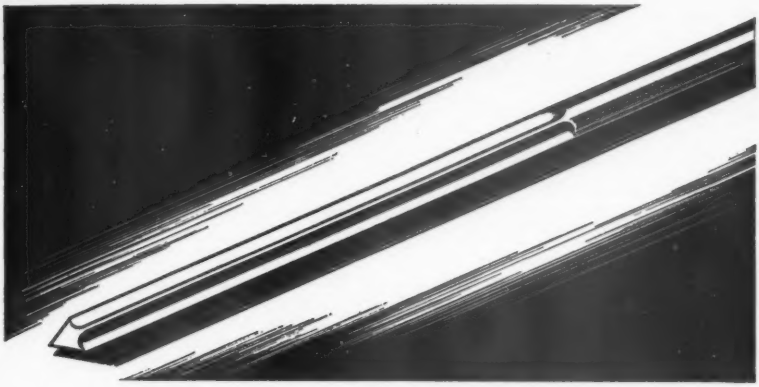


thus completing the reaming from both ends of the holes. Three parts are in process at all times. SNYDER TOOL AND ENGINEERING CO., 3404 E. Lafayette, Detroit 7, Mich., will furnish details. **466-K**

FLEXIBLE WOOD LINK MAT. With rubber and many other materials on the critical list, the American Mat Corporation has developed Flexible Wood Link Matting which has been subjected to the most gruelling factory tests and has withstood abuse way beyond that encountered in common usage. It is light in weight and can be rolled or folded up for easy handling and cleaning. When lying flat,



Flexible Wood Link Matting follows the contour of the floor, makes for safety underfoot, affords good drainage and is comfortable to stand on. The beveled ends reduce the danger of tripping. The mat is 1" thick and comes in stock sizes of 18" x 32", 24" x 38" and 30" x 44" but can be obtained in special sizes of any length and up to 36" in width. Detailed literature is available from the AMERICAN MAT CORPORATION, 1755 Adams St., Toledo, O. **637-K**



L & I Ground Flute Reamers are GROUND FROM THE HEAT-TREATED BAR!

L & I Ground Flute Reamers have proved their superiority . . . in cutting edge, in production performance and in long life—such as the recent record of producing 2,000 holes from a single reamer on work where ordinary milled flute reamers *could turn out only seven holes per reamer!*

One reason for this *extra* performance is because L & I Reamers are *ground from the solid bar* after the round bar has been heat-treated. Thus the stock is properly treated and hardened before the flutes are ground, as a round bar forms the perfect agent for heat-treating and permits of accurate timing of the heating process according to the diameter of the bar. This uniform hardness insures uniform cutting edges and uniform performance for L & I Ground Flute Reamers.

Send us a trial order—or write for illustrated price list on L & I Ground Flute Reamers.

L&I GROUND FLUTE REAMERS

LAVALLEE & IDE, INC. CHICOPEE, MASS.

INDUSTRIAL DIGEST

SCIENCE • RESEARCH • METHODS • TOOLING
PRODUCTION • TRADE NEWS AND REPORTS

A Safety Color Code for Industry

Traffic signals all over the nation speak the same language; a red light means "Stop", a yellow light means "Caution" and green means "Go". Yet many industrial and production plants, tool rooms and die shops do not utilize the training that every one of us has ingrained regarding color association in relation to safety and markings that identify hazards as well as protective and safety equipment.

H. L. Miner, manager of the Safety and Fire Protection Division of the Du Pont Company, and Faber Birren, industrial color authority, decided to do something about it. Working with the Finishes Division, they evolved a new Safety Color Code for Industry. This plan proposes a uniform system of color signals, based on research; it designates color standards to indicate accident hazards, identify protective equipment and assure orderly plant or shop arrangement.

Six colors are recommended: yellow, orange, green, red, blue, white (and black or gray). Yellow, because it has the highest visibility under practically all lighting conditions, is recommended for "strike-against" types of obstacles, equipment, etc. Alternate black and yellow stripes are recommended for unusually strong attention value. Orange is suggested for dangerous elements in machines or equipment—parts which might crush, tear or cut. It is urged for inside parts of machine guards or interior of switchboxes. Green, being traditionally associated with safety, is chosen to mark goggles, respirators and other safety equipment.

Red, traditionally associated with fire protection equipment, is chosen for this purpose only. This would include extinguishers, hose connections, fire protection piping, and fire exits. Blue, associated with caution (railway practice particularly), is suggested for machines shut down for repair or for unsafe equipment. It is also suggested that blue could mark control valves or mechanisms as a "check first" caution. In general the idea is to prevent the use of equipment that might endanger others. The sixth color, white, (together with black and gray for indicated locations) is recommended principally for good plant and shop housekeeping, i. e., for marking aisles other than safety lanes, stock container or bin locations as well as waste receptacles, cuspidors, bottle containers. Gray and black are utilized to give the use of white its maximum attention value by contrast. Gray is recommended as the most practical color for removal receptacles.

A new booklet on the Safety Color Code is available on request to E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. TD, Wilmington 98, Del. 859-K

Recent U. S. Patents

Among recently issued U. S. Patents the following are of Tooling interest. If you are interested in studying any of these Patents, simply advise "Patent Information Service", The Tool & Die Journal, 2460 Fairmount Blvd., Cleveland 6, Ohio, enclosing 20 cents for each Patent desired and we will gladly forward your order to Washington.

MACHINE TOOL, No. 2,334,231.
SURFACE GRINDER SPINDLE BEARINGS, No. 2,334,238.
CUTTING TOOL, No. 2,334,245.
CUTTING TOOL, No. 2,334,246.
METAL CUTTING OR NOTCHING MACHINE, No. 2,334,250.

HERE'S THE

New Model Nichols Miller

Here's the New Model of one of the most versatile precision milling machines on the market.

Besides conventional milling, the Nichols Miller performs dozens of unusual operations — such as profiling, boring, facing, diamond wheel-grinding — *to tolerances in tenths.* Rise-and-fall spindle arrangement and a full line of attachments make the Nichols especially valuable for the toolroom or laboratory.

Worth remembering: Several thousand of these millers are in operation the world over — and we've never required a full-time service man!

WORKING SURFACE: 6¾" x 21", or 6¾" x 30" RANGE: Longitudinal, 10" or 19"; Transverse 7"; Vertical-Knee, 13½"; Spindle Rise and Fall 4½". STANDARD SPEEDS: to 2400 RPM SPECIAL SPEEDS: to 5000 RPM.

Also Available—Nichols Millers for special requirements. Nichols Double-Spindle Millers for high-production needs.

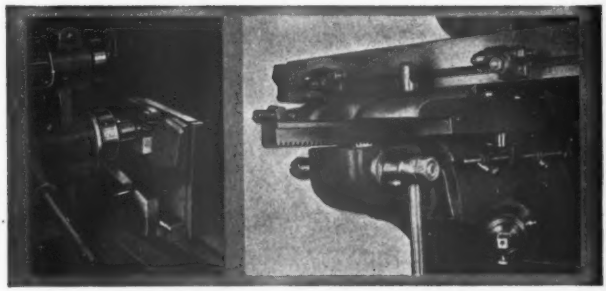
Immediate Deliveries—Send today for descriptive literature and free 86-page Handbook of unusual applications.

EXAMPLES OF NICHOLS VERSATILITY

(Left to right)

PROFILE MILLING, using template and follower, with remarkable ease of control, workpiece under full view.

RACK AND PINION TRANSVERSE FEED, available in place of standard feed screw for rapid motion on drilling, end-milling and boring operations.



Manufactured by W. H. NICHOLS & SONS, Waltham, Mass.

SOLE DISTRIBUTORS

NICHOLS-MORRIS CORPORATION

50 CHURCH STREET, NEW YORK 7, N. Y.

DIAMOND ABRASIVE ARTICLE, No. 2,334,266.
FEED PLUNGER CONSTRUCTION FOR BAR STOCK FEED MECHANISM, No. 2,334,272.
TOOL HEAD, No. 2,334,276.
DRILLING APPARATUS, No. 2,334,278.
TOOL-GUIDING APPARATUS, No. 2,334,301.
BORING TOOL, No. 2,334,363.
DIE CASTING MACHINE, No. 2,334,372.
MEASURING DEVICE, No. 2,334,385.

Blueprint Control

One of the oldest enemies of engineers, architects and designers—the blueprint that is rejected because of insufficient contrast in the original drawing—is tottering on its last legs at The Glenn L. Martin Company in Baltimore, thanks to Douglas J. Wishart and his Legimeter.

The Legimeter is a device for predetermining whether or not a drawing will reproduce satisfactorily while it is still in the hands of the draftsman, or in the case of older drawings, before they are sent to the blueprint machines. It consists of a table having two illuminated panels. In the first panel are samples of drawings from which satisfactory prints have been made by the Army and Navy, selected as standards of minimum satisfactory contrast. The second panel is a sheet of ground glass on which the draftsman can place the drawing to be evaluated. Since both panels are illuminated by light of the same intensity, it is possible for the draftsman to determine at a glance whether or not his drawing is heavy enough for satisfactory reproduction, and if it is not, to "heavy it up" on the spot. The accuracy of the evaluation is assured by the fact that the comparison is made by transmitted rather than reflected light—the same medium used in the actual making of the blueprint.

In addition to the comparison table, the Legimeter includes additional devices for the instruction and training of inexperienced draftsmen in a three panel backboard. The two outside panels, illuminated like the table by transmitted light, contain examples (on the left side) of satisfactory drawings, and on the right, of unsatisfactory drawings. In the recessed center panel, illuminated by reflected light, are the blueprints made from these drawings, prints which have actually been accepted or rejected by the Army. In addition to graphically demonstrating what happens when a drawing lacks sufficient contrast, this backboard provides an ideal means of showing the young draftsman the difference between a drawing that looks all right, and one which will reproduce satisfactorily. For example, the unsatisfactory drawings displayed in the right hand panel are perfectly clear themselves, but the blueprints made from them are faint and in places illegible.

A further training medium is provided in one of the contrast samples on the actual comparison table, with examples of good and bad drafting practice being substituted for an actual drawing.

Engineers of The Glenn L. Martin Company predict that the new device will not only result in the saving of considerable quantities of scarce material now being wasted on rejected prints and the many vital man and machine hours which formerly went into the making of these prints, but that in addition it will go a long way toward compensating for such war necessitated practices as the employment of inexperienced draftsmen, the use of pencil rather than inked drawings with a resultant dimming through usage, mass production of blueprints which hardly ever results in the best print possible, and uneven quality of blueprint papers. Moreover, in the face of the current manpower shortage, it will cut down on the number of draftsmen needed by reducing "heavying up" time, and will assist immeasurably in training draftswomen to replace the draftsmen now being called into the armed forces. Finally, the Legimeter supplies something that has been lacking throughout the engineering profession—a standard for measuring the contrast of pencil drawings.

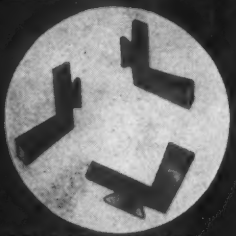
Inventor Wishart is a member of the Martin Engineering Personnel Department, and it was the shortage of draftsmen for "heavying up"—rather than any shortage of materials—that inspired his invention. Unable to meet the demand, he sought about for a way to eliminate the need as the only alternative and the result was the Legimeter. As Wishart puts it, it wasn't an engineering but a personnel problem, and the benefits accruing to engineering departments are purely co-incidental.

LATROBE

MANGANO *and* MANGANO SPECIAL

OIL HARDENING

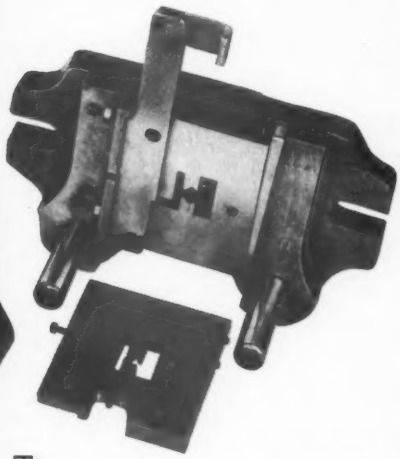
Die Steels



ACCURATE SHAPES EASILY FORMED

WITH PUNCHES AND DIES MADE OF LATROBE OIL-HARDENING STEEL

FOR THIS COMMUTATOR



THE illustrations show one of many jobs involving the production of component parts vital to our war machines. This type of work often demands the use of oil-hardening tool steel with assured minimum distortion.

In such cases, you can depend upon Latrobe Mangano or Mangano Special Die Steels. Write for information.

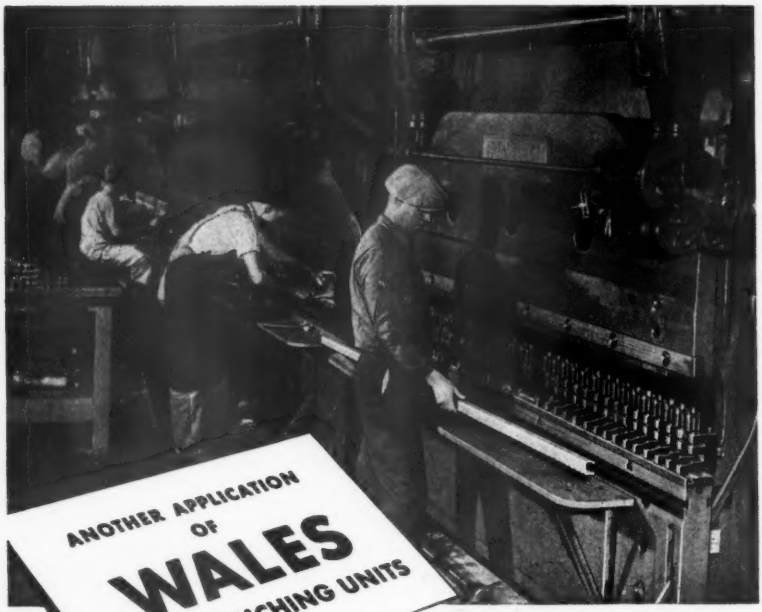
TYPICAL ANALYSIS

	C	Si	Mn	Cr	W
Mangano	.95	.30	1.65	.20	—
Mangano Spec'l	93	.30	1.20	.50	.50

LESCO

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT · · LATROBE · PENNSYLVANIA



IN METAL FABRICATION

FEATURES

Usual time-consuming adjustments of conventional set-ups are eliminated.

Punch and die held in perfect alignment by holder.

Each unit is independent and self-contained.

Straight line, staggered and scattered patterns punched with same units.

Same group of units may be used interchangeably on press brakes and stamping presses.

Nothing is attached to press ram.

Individual units may be instantly removed or reset.

Punches may be interchanged without disturbing set-up.

Die setting and press "down time" reduced to minutes.

Same units may be used and reused in unlimited patterns.

Punching holes in stringers up to 40 feet in length is no longer an obstacle in metal fabrication.

Above illustration shows 3 press brakes side by side equipped with Wales Type "E" Hole Punching Units which will punch holes simultaneously along the entire length of stringers. This is another example of the wide application of Wales Hole Punching Units.

Often, many valuable hours, days, weeks, and sometimes months of important engineering and development time have been needlessly devoted to designing and building special hole punching dies when Wales-Strippit engineers have already solved the problems by using various adaptations of standard Wales Hole Punching Units.

That is why leading metal fabricators are following the timely suggestion of investigating Wales Hole Punching Units before putting holes in channels, angles, and sheets by *any method*.

In addition to all the time-saving, money-saving advantages for standardizing on Wales Hole Punching Units, it pays to keep posted on all the latest Wales-Strippit developments because "There's Always Something New in the Wales Line."

Write for Catalogs Today.

WALES - STRIPPIT CORPORATION

GEORGE F. WALES, *President*

355 Payne Avenue **NORTH TONAWANDA, N. Y.**

(Between Buffalo and Niagara Falls)

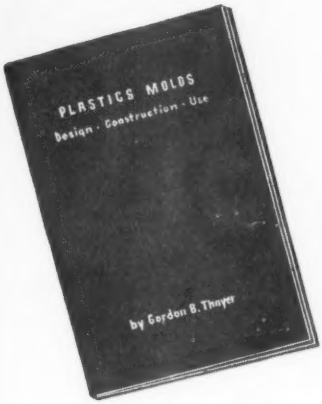
Specialists in Punching and Notching Equipment

Just Published!

PLASTICS MOLDS

Design • Construction • Use

By Gordon B. Thayer



THIS new second edition is more than twice the size of the first edition (published under the title "Plastics Mold Designing" in 1941); contains 20 chapters with many more designs and types of molds and more than 80 drawings and photographs. A new section of Practical Points on Mold Design and Construction and an enlarged Nomenclature of Plastics Molding strengthens this book's position as the leader in its field.

In addition to much new material by Mr. Thayer, several specialists in the field have contributed to the new edition. These include C. Huber Whitlock, Don F. Hoffman, Thomas J. Lester, Wm. J. Dewar and the English authority, F. G. Woodiwiss.

New features include a section on finishing methods and equipment, chapters on loading the injector mold, direct and indirect ejector systems for injection molds, an injection mold for a plastics lens and molding screw threads in plastics.

The new edition of "Plastics Molds" sells at $3.50 per copy, postpaid.

Quantity Discounts

AMERICAN INDUSTRIAL PUBLISHERS

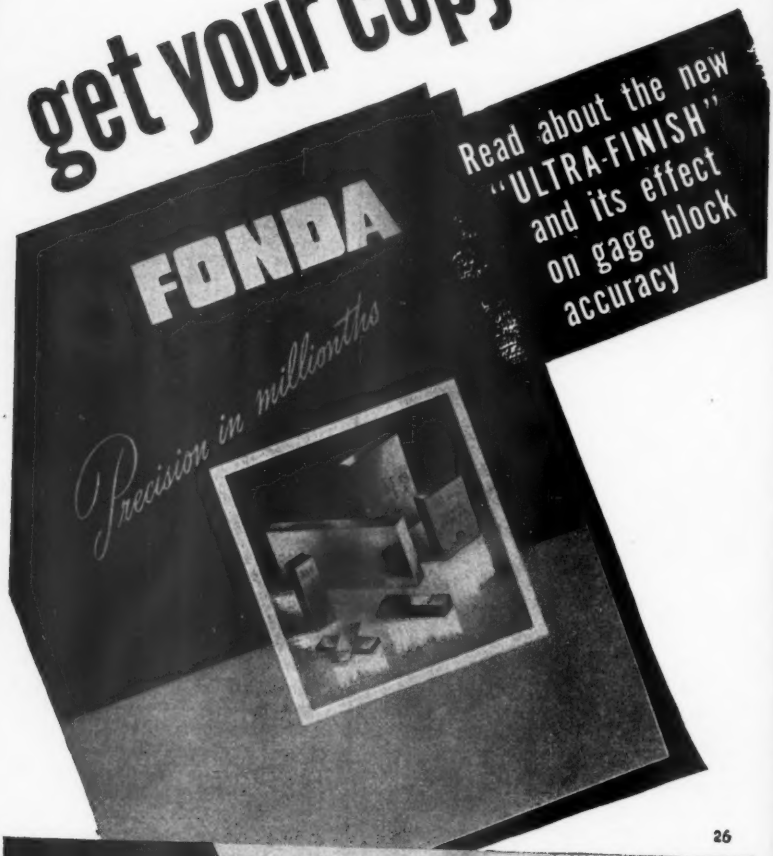
317 Fairmount-Cedar Bldg.

Cleveland 6, Ohio

Supplementary Index

Binocular Headband Magnifier 154
New Hand or Bench Type Gage 158
New Laboratory Furnace 160
Matthews "Sure-Set" Holders. 162
Carson Electronic Micrometer Reads Accurately to .00005" 172
New "Automatic Inspector" Handles 55 Parts Per Minute 174
Foundrymen Hear Wage Incentive Plans Report 176
New Stop-Off Lacquer for Plating Mask 178
"Star Dust" Lapping Abrasives 180
New Engineering Handbook for Arc Welding Tool and Die Steels 182
Towmotor Crane for Machinery Lifting 184
New DoAll Butt Welder..... 186
Synthetic Bushing Simplifies Splined Shaft Coupling Design 190
Cast Resin for Radial Drill Parts 192
Metal Bonded Diamond Hand Hone 194
Rockwood New Chicago Institute Secretary 194
Metallic Arc Welding of Aluminum 196
Hold Work at Any Angle.... 198
Shop Built Tubing Straightener 200
Interchangeable Hexagon Bed Turret 202
Carbide Tools Free Three Machines; Speed Up Production Rates 204
Lens Cleaner Dispenser 206
Dayton Rogers Cushion Blanking Dies 208
Thomas Redesigns Bending Rolls 210
Berwick Electric Metal Heater. 214
Internal Grinder Uses Electro-Hydraulic Control 216
Contract Tooling and Production (Shop Listings) 218

get your copy...



26

Write for Bulletin C

FONDA GAGE CO.
Stamford, Conn.
Agents in All Principal Cities throughout the World

FONDA GAGE BLOCKS PASSED HIGHEST TESTS DEVISED BY NATIONAL BUREAU OF STANDARDS

Name your toughest finishing job . . . ONE OF

THESE SKILSAW TOOLS

will do it *FASTER, BETTER, EASIER!*

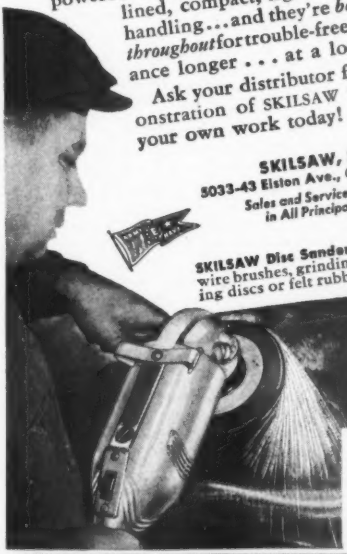
• If your problem is grinding down heavy weld beads or removing heavy burrs . . . a SKILSAW Portable Grinder will speed the work. If it's cleaning off spot welds, or polishing curved or flat surfaces of any material . . . one of these SKILSAW Disc Sanders or Belt Sanders will do the job better, and easier!

SKILSAW Disc Sanders, Belt Sanders and Portable Grinders, like all SKILSAW TOOLS, are *built to stand the gaff.* They're powered for extra fast work . . . streamlined, compact, lighter for easier handling . . . and they're *better-built throughout* for trouble-free performance longer . . . at a lower cost.

Ask your distributor for a demonstration of SKILSAW TOOLS on your own work today!

SKILSAW, INC.
5033-43 Elston Ave., Chicago 30, Ill.
Sales and Service Branches in All Principal Cities

SKILSAW Belt Sanders • Do all sanding and finishing on flat surfaces of metal or wood. Powerful, rugged!
SKILSAW Portable Grinders • Best tool for grinding down heavy welds, studs. Ball bearing construction.



SKILSAW Disc Sanders • Used with wire brushes, grinding wheels, sanding discs or felt rubbing pads.

• Planning for After the War? Let Skilsaw Field Engineers help you now to plan "tooling-up" for peacetime production, with Skilsaw's new post-war tools.

SKILSAW PORTABLE ELECTRIC TOOLS

MAKE AMERICA'S HANDS MORE PRODUCTIVE

WHEN YOU CHECK UP ON YOUR PLANT'S PAY-ROLL SAVINGS PLAN FIGURES!

These days, things change with astonishing speed. The Pay-Roll Savings Plan set-up that appeared to be an outstanding job a short time ago, may be less than satisfactory today.

Check up on *your* plant. Check up to see if all are playing their parts to the full. Check up to see if 'multiple-salary-families' are setting correspondingly multiple-savings records.

Other groups may need attention. Workers who have come in since your plant's last concerted bond effort. Or, those who have advanced in pay, but not in their bond buying. Or those who never took part in the plan at all. A little planned selling may step contributions up materially.

Your job isn't finished, even when you've jacked participation up to the top. You've still got a job before you! The task of educating your workers to the necessity of not only buying bonds, but of *holding* them. Of teaching that a bond sold before full maturity is a bond robbed of its chance to return full value to its owner—or his country!

So start *checking* . . . and *teaching* . . . today!

War Bonds To Have And To Hold!

LET'S ALL BACK THE ATTACK WITH WAR BONDS!

The Treasury Department acknowledges with appreciation the publication of this message by

Staff of the TOOL & DIE JOURNAL

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

Tools and gages to your specifications

Accuracy to thousandths . . . . . Yes, even millionths. Our complete inspection laboratory is scientifically air-controlled. The elimination of temperature variations assures positive accuracy to your specification.

Master gages measuring millionths of an inch enable us to build jigs, fixtures, gages, and precision parts to the most exacting Army and Navy requirements. Have our experienced toolmakers with an Army-Navy "E" reputation solve your tooling problem. Our 24 years of experience will save you time and costly errors.

The most modern machines and tools for producing special tools, gages and ground threaded parts are available to manufacturers with war orders. Reasonably prompt deliveries can be made. Send blueprints for immediate quotation and delivery schedule.

TOOLS & GAGES, INC

3112 EAST 63RD STREET • CLEVELAND, OHIO

A Self-Contained Pneumatic Forging Hammer

The Chambersburg Pneumatic Forging Hammer has a greater forging output than any other hammer of its type. Added to the advantage of more powerful blows is that of greater rapidity of blows, which permits working the forging at higher temperatures.

The hammer is of the self-contained type, having a compressor piston cylinder and ram cylinder in which a compressor piston and a ram operate. In operation the ram is driven up and down by a flexible air force, created by the compressor piston. The compressor piston is driven by an electric motor of high speed through two stage speed reduction gearing.

The hammer can be started instantly and strikes a constant number of blows heavy or light at the will of the operator. As soon as the motor is up to speed the hammer is ready to operate.

Made in 3 types:

1. One Piece (as above), 200 lbs. and 300 lbs.
2. Solid Frame, 300 lbs. and 500 lbs.
3. Two Piece Frame, 750 lbs. and upward.

A new bulletin is now available . . . Write for your copy

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

CHAMBERSBURG

HAMMERS · CECOSTAMPS · PRESSES

PUBLICATION PREVIEWS

SALES AND TECHNICAL LITERATURE

Send Request on Company Letterhead

BARRETT-CRAVENS Material Handling Equipment. The Barrett Handling Equipment described and illustrated in their Catalog, No. 501, is the result of 28 years experience in this field. Profusely illustrated, this 160-page catalog covers Lift-Trucks, Steeleg Platforms, Special Purpose Trucks, Platform Trucks, their Nifty Lifter System, Storage Rack Systems, Portable and Stationary Elevators, Hoists, Portable Cranes, Barrel Trucks and Drain Racks. Barrett equipment saves time and labor in material and product handling. It enables one man to handle 6000 pounds where he formerly handled only 500. How this equipment can be applied to your needs is told in the pages of this catalog. The several types of Barrett Lift-Trucks are described and illustrated in detail—that new system of "shipping on skids" is explained—followed by Portable Elevators that stack goods ceiling high—and Storage Rack Systems that permit the full utilization of available cubic feet. Supplementary bulletins cover Barrett Lifting Tables, Multi-Duty Die Tables and Die Elevators for handling heavy die sets in and out of presses and between the press room and storage facilities. **982-K**

INSTA COOLANT CUTTING COMPOUND —fills the need for a lubricant that will cling to drilling and cutting tools and enable the machinist or operator to produce precision work and also prolong the life and sharpness of his cutting and boring tools. It is recommended for cutting any metal up to Armor Plate. It contains a chemical which the manufacturers call "Item X" which provides constant lubrication upon the cutting edge of cutting tools or upon the cutting point of the drill. It is claimed not to be an oil but a "colloidal substance" which reacts chemically upon the two metals in contact, the drill or cutting tool and the part worked upon, and prevents friction and cohesion because frictional heat is reduced to a minimum and in most cases entirely eliminated. Further information is available from the FINEGAN-CAMPBELL CO., Dept. TD, 1016 Baltimore Ave., Kansas City 6, Mo. **968-K**

"POWDER METALLURGY"—A new 32-page booklet covering the advantages and latest applications of powdered metal parts has recently been published by KEYSTONE CARBON CO., INC., manufacturers of precision moulded parts, Dept. TD, Saint Marys, Pa. The Designers Aid Section and table on Engineering Properties should be of particular interest to companies investigating the possibilities and advantages of parts produced by this method. Types of design and specifications

for standard forms as well as intricate shapes are presented in detail. Selflube Porous Bronze Bearings, Selflube Porous Iron Bearings and D-10 Graphite Impregnated Brass Bearings are also featured. These low friction materials have almost unlimited possibilities and are a distinct contribution to the field of powder metallurgy. In addition to catalog listing of standard shapes and sizes available, technical data on performance, installation and care is included. **962-K**

STANDARD TALIDE drill jig bushings made of solid Tungsten Carbide Metal and precision ground to a mirror-finish are featured in Catalog No. JB-44 issued by METAL CARBIDES CORP., Dept. D, 107 E. Indianola Ave., Youngstown 5, Ohio. In addition to guiding drills and punches, Talide Bushings are ideal for sizing work and for use as bearings, center bushings and guide bushings. They prove especially economical on long run production jobs because they reduce down-time and eliminate the need for frequent replacements. Standard sizes and styles available and new, reduced prices are listed. Complete specifications and prices on standard Talide-Tipped Plug and Ring Gages, tipped with Talide Metal, are listed in Catalog No. PG-44. Talide Metal is a superior grade of Tungsten Carbide ideally suited for gage purposes, because of its exceptional density, strength and hardness. Please designate the number of bulletin desired. **717-K**

"WHEN THE SHOOTING STOPS" is the title of an 8-page booklet containing published articles representing five business-wise points of view, based on Spriesch activities. The time to think about post-war production is now. Joseph J. Cheney, President of the SPRIESCH TOOL & MFG. CO., INC., Dept. J, 10 Howard St., Buffalo, N. Y., says that anyone who attempts to convert back to peacetime production by simply dusting off his old jigs and fixtures and get going again will find that his revived product is antiquated. Cheney is willing to devise modernized products, make the blueprints, prepare the tools to make the products or even make the products. **949-K**

TAPPING MACHINES AND TAPS are illustrated in Bulletin T.M.—5M—5-42 issued by the RICKERT-SHAFER CO., specialists in thread cutting equipment, Dept. D, 633 W. 11th St., Erie, Pa. The R & S Friction Drive is simple in design and operation. Press on the work and the back friction operates to start the tap into work—a slight pull on the work and the front friction revolves 40% faster to reverse the tap in an instant — thus eliminating "busted" taps. Bulletin "C" contains information on the automatic—self-opening Die Head. No screw driver, wrench or other device is required for changing chasers. Please designate catalog desired. **441-K**

STANDARD RATED INDUSTRIAL FURNACES are illustrated and described in a catalog consisting of numerous bulletins published by SURFACE COMBUSTION, Dept. TD, Toledo, Ohio. Design features of general, oven, atmosphere, convection and pot type furnaces are included. In addition to standard rated furnaces, Surface Combustion designs and builds special equipment for heavy and continuous production. These special furnaces are designed to meet the most exacting metallurgical demands and may range from small pilot units to mammoth, completely automatic,

TOSS THAT
EXTRA TOUGH
DIE PROBLEM
INTO OUR LAPS

Using Strenes Metal, we'll cast your dies to shape, (usually to 1/16") and save you around 50% to 75% on machinery time. What's more you'll put to work a die that will stand up—draw and form far more stampings than you probably believe possible. Deep draw runs of 1,000,000 and more parts a matter of record.

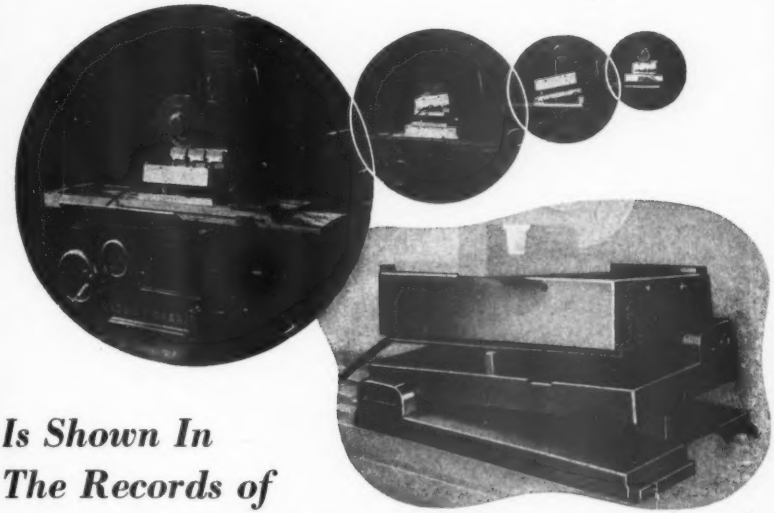
You'll be using a die that will require redressing far less frequently than dies of ordinary metal. Sounds good, but, hard to believe, you say! Perhaps. But our suggestion stands "Toss us that tough one" and pay for it when Strenes makes good as claimed—otherwise there will be no charge.

THE ADVANCE FOUNDRY CO.
Dayton 3, Ohio

Refrigerators
Stoves
★ Automobiles
★ Trucks
★ Tractors
Metallic Vaults
Metallic Caskets
Farm Equipment
Fans, Blowers
Bicycles, etc.
★ In automotive field in general use for drawing and forming car bodies, hoods, fenders, head lights, radiator shells.

Strenes METAL
DRAWING & FORMING DIES

MAGNA-SINE *Usefulness*



Is Shown In The Records of

HUNDREDS OF "REPEAT" ORDERS

It has been proved many times that, once the advantages of the Magna-Sine have been seen in a plant, this modern method of securing angular grinding set-ups becomes standard shop practice . . . and as many Magna-Sines as can be practically used are purchased. Here are typical examples of how leading companies* have added Magna-Sines to their grinding equipment to get greatest efficiency and accuracy in both single and compound angle set-ups:

1. **Company A . . . purchased their first Magna-Sine January 16, 1937 . . . now have 57 in regular use.**
2. **Company B . . . purchased their first Magna-Sine October 5, 1936 . . . now have 41 in regular use.**
3. **Company C . . . purchased their first Magna-Sine January 31, 1941 . . . now have 45 in regular use.**

Check the grinders on which you can use additional Magna-Sines. If you want complete information and prices on the size and type of units best suited to your production, see your nearest Robbins representative, or write us direct.

***Names of companies will be supplied upon request.**

ROBBINS ENGINEERING COMPANY
318 MIDLAND AVENUE • DETROIT 3, MICHIGAN

highly mechanized units. Such a unit may consist of a single furnace or a number of furnaces arranged to provide a complete and continuous heat treating system. **810-K**

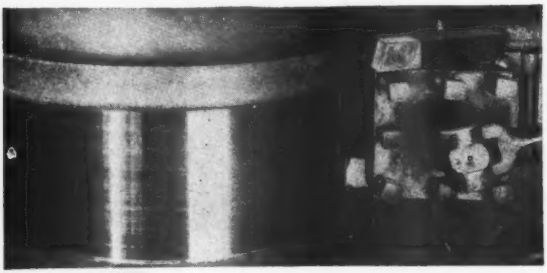
SMALL REAMERS from 1/32" to 5/8" diameter for precision work are illustrated in a descriptive circular issued by METAL CUTTING TOOLS & MFG. CO., Dept. J, 11121 Grand River Ave., Detroit 4, Mich., small reamer specialists. Built to precise, exacting standards, these reamers are recommended for finishing holes to decimal tolerances on aircraft, small arms, instruments, motors, engines, radio or any part that calls for extreme reaming accuracy. **948-K**

TOOLS FOR PRODUCTION including Rousselle Punch Presses, Victory Vises and Adjustable Spacers are detailed and illustrated in Bulletin 643 issued by the DAVID J. ROSS CO., INC., Dept. T, Benton Harbor, Mich. A free service is offered to manufacturers interested in reducing costs through improved punch press operations. The Automatic Knockout Bar and the Non-Repeating Clutch are standard safety equipment on all Rousselle presses. Further information is contained in the above bulletin. **160-K**

BINOCULAR HEADBAND MAGNIFIER which promotes accuracy, prevents eyestrain and speeds production is illustrated in leaflet MED. 258-542 issued by CARL ZEISS, INC., Dept. T, 485—5th Ave., N. Y. C. This magnifier leaves the hands free and permits the use of both eyes (eyeglasses may be worn), thereby revealing the true depth of details, as well as the thickness and shape of the object being viewed. Its large and clear field of view, binocular vision and 2¼ times magnification are a great aid to craftsmen doing high precision work or inspection jobs. **945-K**

COLLET CHUCKS of solid steel construction, hardened and ground to insure against wear, are illustrated in Bulletin 244 published by the ALLISON TOOL & ENGINEERING CO., Dept. T, 4031 Whittier Blvd., Los Angeles 23, Cal. A one-handed operation is all that is required to obtain high, almost frictionless pressures — a short pull toward operator tightens collet—a push away from operator releases it. There are only five moving parts in the Allison No. 1 Collet Chuck which requires no keys, wrenches, reverse switching or stopping at any time during operation. Because all of the parts of the Allison No. 2 Collet Chuck are of a circular nature and well balanced, it is adaptable to polishing lathes and other high speed spindles, as well as automatic screw machines. The No. 3 Collet Chuck, sturdily designed with a 1⅝" collet capacity for lathes having spindles up to 2½" in diameter, will maintain accuracy and give engine lathes full spindle bore capacity with turret lathe operating speed. **960-K**

MILLING MACHINES AND ATTACHMENTS are illustrated and detailed in a catalog and price list issued by the BURKE MACHINE TOOL CO., Dept. J, Conneaut, O. These tools are built to a high degree of accuracy and, as no weight has been sacrificed, they will perform any work within their size range. All screws have graduated dials, graduated in .001.



CROBALT

SOLID AND TIPPED TOOLS

● CROBALT solid and tipped tools are available in standard and special shapes and sizes. Whatever your operation—turning, facing, boring or milling—CROBALT superior cutting tools will provide longer tool life, maximum machine output and long-run economy. CROBALT maintains a staff of engineers to assist you.

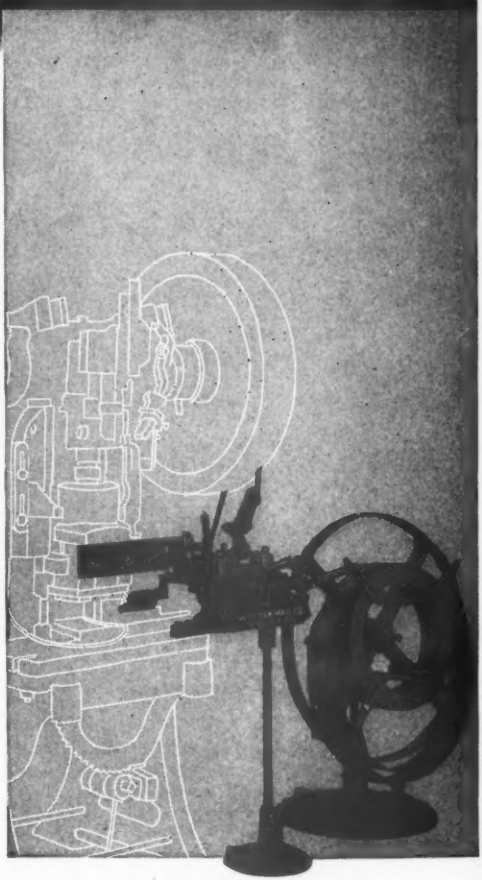
Write for catalog and prices.

CROBALT INC.
ANN ARBOR, MICH.

Our Punch Presses Are More Flexible And Productive With WITTEK *Automatic* Roll Feeds And Reel Stands

Manufacturers of metal stampings facing problems in the feeding of coiled strip stock to punch presses will find that Wittek Automatic Roll Feeds and Reel Stands conserve man-hours and achieve new high production levels.

Providing an improved and simplified method of punch press operation, Wittek Automatic Roll Feeds and Reel Stands insure rapid, safe and accurate feeding under all conditions. Made in four different types to meet all automatic feeding requirements. Write for complete details. Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago, Ill.



ARMY E NAVY

WITTEK WMCo *Automatic*

ROLL FEEDS and REEL STANDS

For All Makes and Sizes of Punch Presses

Motors are mounted low on the column and to one side which makes them extremely convenient for the changing of speeds. **661-K**

BORING BARS—illustrations, specifications and price lists of jig boring bars, lathe boring bars, boring bar holders, triangle tool bits and "special" boring bars are presented in a catalog released by the EVEREDE TOOL CO., Dept. T, 180 N. Wacker Dr., Chicago 6, Ill. The Everede Boring Bar Holders are adjustable to various size lathes. These holders always keep the boring bars in a horizontal position regardless of any change of the size of lathe, within certain limits. **958-K**

BORING HEADS, particularly adapted to the use of cemented carbide tools due to their rigid construction and fine adjustment, are described and illustrated in literature available from CRITERION MACHINE WORKS, Dept. D, Beverly Hills, Cal. These boring heads have threaded backs which make possible, with the use of interchangeable shanks, their adaptation to various machines. Smooth and compact in design, these heads have no sharp or hidden recesses with which to collect dirt, oil, grease or chips. **254-K**

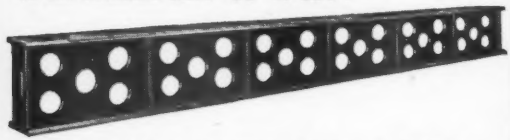
PARKER-MAJESTIC ROTARY GRINDER—can be easily adapted for use in a multitude of production and semi-production applications. All controls and switches are mounted on the machine directly in front of the operator. Three switches control the spindle, the coolant pump and work spindle drive motor. No external key is used on its permanent magnetic type chuck. Further information is contained in a descriptive folder published by the MAJESTIC TOOL & MFG. CO., Dept. J, 2950 E. Woodbridge St., Detroit 7, Mich. **624-K**

SPEEDICHUK AND PRECISION BREN COLLET is a combination featured by the General Die-Stamping-Tool Company's 4-page bulletin and supplements. Featuring a 50 percent increase in work capacity the new Speedichuk and the uniquely designed Bren Collet permit collet work on round stock up to ¾" with small lathes having a normal capacity of only ½". Speedichuk requires no adapter plate, and is quickly fitted to any lathe with a 1½" x 8 thread spindle nose having a No. 3 Morse Taper on the inside. It is the only collet chuck using a floating closing sleeve which compensates for wear and misalignment of lathe spindle. The six-inch handwheel assures maximum gripping pressure on collet with minimum effort, and the heavy construction provides complete rigidity. The Bren Collet has been specially designed to allow use of full capacity through spindle. It has a No. 3 Morse Taper body which conforms to taper of spindle. Maximum spindle accuracy is utilized for the first time by combining tapered closing sleeve on body of collet. This achievement eliminates inaccuracy of conventional type collets which require separate adapter closing sleeves. Closed by squeeze action, Bren Collet avoids longitudinal movement. For continuous and speedy

Challenge STRAIGHT EDGES

HAND-SCRAPED

● Made of a special analysis semi-steel, Challenge hand-scraped Straight Edges are scientifically shaped and ribbed to retain a straight line. Made in ten standard sizes—18" to 120".



PARALLEL STRAIGHT EDGES

HAND-SCRAPED or PRECISION GROUND

For leveling and setting up of machine units, in the laying out of production and assembly lines. Made of close-grained semi-steel and cored for lightness. Four standard sizes.

OTHER SURFACE PLATE EQUIPMENT

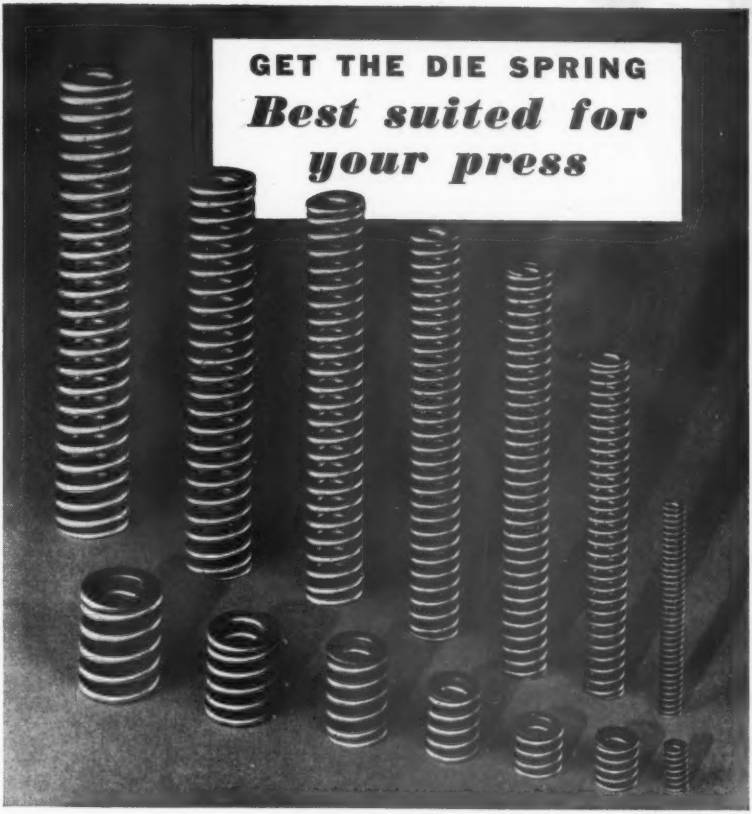
Includes Right Angle Irons, V-Blocks, Parallels, and Angle Plates. Write for data on any item.

483

THE CHALLENGE MACHINERY CO.

Main Office and Factory: GRAND HAVEN, MICH.

Eastern Sales Office: 50 Church Street, NEW YORK



Designed to meet the rigorous requirements of your presses, Muehlhausen Die Springs of the proper sizes and types can assure you finer, faster die work.

Muehlhausen Die Springs are available in Series "S" for high speed; "M" for regular speed; and "HD" for heavy duty presses. Over 200 sizes are stocked, ranging from 1 to 15 inches in length, and exerting pressures from 80 to 3,000 pounds.

FREE BULLETIN!
New Die Spring Booklet describes 206 sizes and types of die springs.

Muehlhausen Spring Corporation
875 Michigan Ave., Logansport, Ind.
Send New Die Spring Booklet, Free.

Name_____

Address_____

City_____ State_____

MUEHLHAUSEN
MS
SPRINGS
EVERY TYPE AND SIZE

production Speedi-chuk is also offered with hand lever control. Also illustrated is their new Precision Lever Type Cross-Slide which incorporates a patented tool leveling adjustment. General Die-Stamping-Tool Company's several tooling accessories can combine to make highly efficient manufacturing lathe set-up out of a small lathe in the Atlas, Logan or 9" South Bend size category. Illustrated literature may be had from GENERAL DIE-STAMPING-TOOL CO., Dept. J, 265 Canal St., New York 13, N. Y. **706-K**

1944 AIRCRAFT TUBING MANUAL—This revised and enlarged manual containing latest tables, specifications and recommendations on the handling, protecting and installation of aircraft tubing and fittings has been compiled by TUBING SEAL-CAP, INC., Dept. TD, 215 W. Seventh St., Los Angeles, Cal. Included is information on the importance of proper torquing as well as tables on recommended torquing procedure. Thirteen reasons why seal-caps and seal-plugs are the most effective method of protecting and sealing tubing, threaded fittings and hydraulic units are given. **99-K**

INTERCHANGEABLE DRILL TIPS are the theme of a folder released by CONNER TOOL & CUTTER CO., Dept. D, 5555 Conner Ave., Detroit 13, Mich. It is no longer necessary to buy different sized drills. You merely buy drill tips in the sizes you need when and as you need them. The Conner Multi-Tip Drill comes in standard taper-shank holders—each holder accommodating several interchangeable drill tips (standard sizes). These tips are made of hardened, high-speed steel in steps of $\frac{1}{16}$". Special sizes are available as you need them. A price list for tabulated sizes of holders and tips is also enclosed. **944-K**

MASTERCASED CUTTING TOOLS are made by a super heat-treating process perfected by MASTERFORM TOOL CO., Dept. J, 2532-48 Irving Park Rd., Chicago 18, Ill., manufacturers and designers of special circular, flat, dovetail form tools, special milling cutters, reamers, drills, countersinks, counterbores, end mills, taps and associated products. Mastercased - Masterform precision cutting tools are made in a wide variety of types and sizes, to meet individual requirements. Further information is available in a 4-page leaflet issued by the company. **946-K**

AUTOMATIC WORK DRIVERS are diagrammed and illustrated in Bulletin D-43 issued by the SENECA FALLS MACHINE CO., Dept. J, Seneca Falls, N. Y. These self-centering, quick-acting, positive Work Drivers are designed to eliminate dogging time, thus permitting one operator to operate two or more machines. They may be used on any type of Engine Lathe, Multiple Tool Lathe and on Plain or Universal Grinders—in fact, on any machine carrying work on centers and requiring a means of rotation. These drivers have also been used to good advantage on Turret Lathes for driving work mounted on a stub arbor. This method eliminates the necessity of pressing the

What I Like About
DE-STA-CO
ARBOR SPACERS
De-Sta-Co spacers save a lot of time when setting milling machine cutters . . . they do away with much idle machine time and thus increase production . . . they are offered in all standard arbor sizes and in thicknesses from .001" up, including long spacers cut from bar stock and ground to decimal . . . they are made from metal and therefore are not affected by temperature changes . . . they may be used over and over again, which makes them the lowest in cost of any arbor spacers you can buy.
SEND $1.00, giving us size of your arbor, and we will send you a special trial assortment of spacers, sufficient for average use on a machine.
DETROIT STAMPING CO.
Established Over 25 Years
344 Midland Ave • Detroit 3, Mich.

Here's an outstanding time and money saving tool for your parts numbering operations—the Mercury Interchangeable Type Holder. It provides for fast, accurate and fully legible numbering of metal parts, eliminating errors, rejects and the time normally consumed in using single-character dies.

HERE'S ALL YOU DO:

Unlike ordinary one-character dies, which must be used separately, the Mercury holds the entire part number—up to 16 digits, if needed. You simply "load" the tool with the correct part number and snap the cover shut. *Thereafter, as many duplicate parts as desired can be quickly and neatly stamped with just a single blow of the hammer for each part!* Time normally lost using a separate die for each separate digit is *saved*, and overlapping, wrong sequence and illegible numbering are eliminated.

The Mercury Type Holder has many more outstanding features you should know about. Type is quickly interchangeable for different part numbers . . . compactness aids in stamping smaller parts . . . all-steel machined construction insures long life, cuts replacement needs. Hardened and ground hand-cut steel type is available in a full range of sizes. Full details, including ordering data and specifications for both hand and press style holders, are contained in descriptive bulletin mailed free on request. Write for your copy today—ask for Mercury Bulletin 1-D

Immediate Delivery

MERCURY METAL DIE AND LETTER CO.

546 EAST 16TH STREET, LOS ANGELES 15, CALIFORNIA

piece on the arbor. **459-K**

INDUSTRIAL TRUCKS and tractors are detailed and illustrated in Electric Truck Catalog No. 52 recently issued by the BAKER RAULANG CO., Baker Industrial Truck Div., Dept. J, 2168 W. 25th Street, Cleveland 13, Ohio. This handbook of information on material handling with power trucks, designed to facilitate selection of the proper equipment for any set of requirements, should be of help to plants or warehouses faced with transportation problems. In addition to listing all of the standard Baker electric trucks, it illustrates many of the special models which have been designed for unusual handling operations. **199-K**

"AIRGRIP" Pneumatic and Hydraulic Holding Devices are presented in a catalog issued by ANKER-HOLTH MFG. CO., Dept. T, 332 S. Michigan Ave., Chicago 4, Ill. The "Airgrip" Three Jaw Universal Chucks are designed to permit heavier cuts and coarser feeds, saving time and effort in production, and are of special service in heavy production work. Distinctive features of "Airgrip" Model "D" Air Cylinders include double ball bearing, permitting speeds heretofore impossible; no manual adjustments required; balanced air pressure—no end thrust; minimum friction; sturdy dependable construction; long life—low maintenance. Diagrams of expanding arbors and collet chucks for projectiles from 20 mm up to 155 mm are included. **952-K**

"BALANCED WET BULB" CONTROL—the Niagara Aero Heat Exchanger uses the principle of exaporative cooling for the temperature control of liquids or gases to within 2° F. A constant fluid temperature is maintained by operation of the air recirculating system. In cooling, a falling temperature automatically operates dampers to use more recirculated air. The air in contact with the cooling coil has the maximum wet bulb temperature at all times. In heating, a steam injector or electric immersion heater builds up and maintains spray water temperature. The Niagara has many industrial applications including cooling of water and oil quenching baths, cooling of engine jacket water, air compressors, motor generators, bearings and degreasers. Further information is contained in Bulletin 96 issued by the NIAGARA BLOWER CO., Dept. D, 6 East 45th St., N. Y. 17, N. Y. **411-K**

TWO SPINDLE
Adjustable
DRILL HEADS
Drill Two Holes At Once

✓ *Adjustable Centers from ½" to 6"*
✓ *Drill Capacity 0 to 5/8"*

Sleeve and overarm types . . . in several sizes. Will double output of any single spindle drill press.

Quickly adjusted to desired drill centers from ½" to 6".

Send for bulletin.

LINDERME MACHINE & TOOL CO., INC.
12250 Coyle Ave., Detroit 27, Mich.

HARD-FACING ALLOYS are discussed in a booklet published by STOODY CO., Dept. T, 1134 W. Slauson Ave., Whittier, Cal. These alloys, supplied in welding rod form, resist all types of abrasive wear and prolong the life of industrial equipment two hundred to two thousand percent. Worn equipment rebuilt with proper type of welding rod and given a final overlay with a Stoody hard-facing alloy not only regains its original usefulness, but many times outlasts new, unprotected equipment several times. When the hard metal deposit finally wears away the same part can be hard-faced again and again and it is no longer necessary for the operator to carry a

REDESIGNED!

Now

YOU HAVE A TOGGLE C-CLAMP WITH
GREATER STRENGTH • LIGHTER WEIGHT

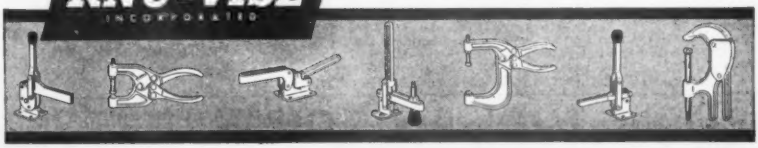
Added strength has been given this clamp (Model 505) by forging, which also permitted the redesigning to effect a reduction of 17% in weight.

Throat capacity was increased where it was most needed. The clamp now possesses better balance which makes for easier handling. A wing nut supplants the knurled head to facilitate original adjustment.

Once adjusted for required thickness, clamp remains at that setting for repeated clampings. No screwing or unscrewing necessary.

KNU-VISE
INCORPORATED

1330 Plum Street, Detroit 16, Michigan
4328 San Fernando Rd., Glendale, Calif.



heavy spare parts inventory. Tube Borium, Borod and Stoody Self-Hardening are a few of the welding rods mentioned. **947-K**

SUN DIAL INDICATOR GAUGE—a measuring instrument primarily intended for screw machine products (also any other machined item having depth and length), designed to meet your specifications, enables you to take readings of variations as small as .0001. It does not require any expensive measuring equipment, either for its checking or setting. A simple master setting gauge, supplied with each Sun Dial Indicator Gauge, provides a quick and reliable method of setting and checking. Information is contained in a leaflet issued by the SUN TOOL & GAUGE CORP., Dept. TD, 380 Canal St., N. Y. C. **955-K**

ALUMINUM RESEARCH PUBLICATION—Demand for the Aluminum Research Institute's publication, "Standard Methods for the Sampling and Analyzing of Aluminum and Certain Aluminum Alloys", has resulted in the reprinting of the second edition. Detailed chemical methods that have been thoroughly tested and proved for the determination of various elements present in aluminum alloys are included. First published in 1932, with a revised edition in 1939, it is in world-wide use in public and private laboratories, technical schools and libraries. Copies may be obtained for 70c (to cover costs and mailing), from the ALUMINUM RESEARCH INSTITUTE, Dept. TDJ, 111 W. Washington St., Chicago 2, Ill. **967-K**

THOMPSON SPRING COLLET ADAPTER—consists of only two parts, eliminates large heavy chucks and provides free access to work and cutter. This gripping and accurate adapter brings the cutter in closer relation to the work. This information is presented in literature available from the MAGUIRE INDUSTRIES, INC., Thompson Tool Div., Dept. J, 342 W. Putnam Ave., Greenwich, Conn. Also issued by this company is a leaflet on the Thompson Universal Milling Fixture which has been designed especially for converting any standard bench lathe into an economical time-saving machine. Please specify literature desired. **640-K**

CURVED TOOTH MILLING CUTTERS including Woodruff Keyway Cutters, Stagger Tooth Side Milling Cutter and Overlapping Keylocking Side Milling Cutters are featured in a folder issued by ABER ENGINEERING WORKS, INC., Dept. J, Waterford, Wis. Curved tooth overlapping side milling cutters are used for slabbing cuts where a distance from side to side must be maintained, and due to the fact that the curved teeth angle toward the center, they adapt themselves to radius corners when desired. This type of

KALAMAZOO Metal Cutting BAND SAW

The Band Saw Principle is More Efficient as the Cutting Action is Continuous.

Speedier and More Accurate Cut-off Work for Smaller Cost.

More Speed and Accuracy on Cut-Off Work at a LOWER COST

Thousands of progressive war plants have learned that the Kalamazoo band saw is far more efficient, convenient and accurate on most of their cut-off work than other methods. They have learned that this compact, low-cost machine can do most of the work heretofore handled on large, expensive machines.

This equipment has pointed the way to increased savings NOW and also on after-the-war production.

Two sizes—8" x 16" and 8" x 24". Cuts solids, tubes or odd shapes. Four speeds for cutting any metal. Portable and plugs into light circuit.

DRY MODEL—Machine illustrated is suitable for intermittent cutting.

WET MODEL—Coolant attachment can be supplied for above machine or machine can be purchased as a complete unit with coolant. Attachment does not interfere with convenience or portability and permits high speed, continuous, straight line cutting.

WRITE FOR BULLETIN OR ASK YOUR DEALER

MACHINE TOOL DIVISION

KALAMAZOO TANK & SILO CO.
KALAMAZOO, MICHIGAN

AMAZING DISCOVERY REVEALED

NEW MIRACLE CUTTING-COMPOUND

Leading War Plant Reports Sensational Results In This Accurate, Reliable Test

Drilling armor plate, a quota of 300 pieces per eight hour shift per drill press was established but had never been met. Two regular operators on identical drill presses, doing the same work, one using INSTA as the coolant, the other using standard cutting oils were selected.

BELOW ARE THE RESULTS OF ONE DAY'S RUN:

	Operator No. 1 Regular Cutting Fluid	Operator No. 2 INSTA
Rate (hr.)	$ 1.00	$ 1.00
8 hr. Production units	75	300
Unit Costs—Labor	$ .106	$ .026
Operation Stoppages (To replace or sharpen drills)	18	0
Labor Cost 300 Units	$31.80	$ 8.00
INSTA		$ .75
Total Cost (300 Units)	$31.80	$ 8.75
Saving with INSTA (300 Units)		$23.05

- ★ Increased Speeds and Feeds
- ★ Cuttings Same Color as Metal Stock
- ★ Reduces Rejects
- ★ Non-Injurious to Skin
- ★ Practically Eliminates Smoke
- ★ Precision Work Quick
- ★ Amazing Increases In Tool Life

ACTUAL STATEMENTS from Outstanding Defense Plants Praise Its Unbelievable Results

"Nothing like it for machining and drilling."
"Truly a miracle."
"Hard to believe actual results."
"Astounding."
"Can't be done — but INSTA did it."
"Greatest time-saver ever used."
"Greatly increased our production."
"Practically eliminated tool breakage."
"The drill doesn't seize."
"Will save us thousands this year."
"We advise INSTA for all machining."
"Your claims understated."
"Truly the vehicle for shop profits."
"Our men won't be without INSTA."
"Worth many times its cost."
"Surely speeds up our war production."
"Timely — we have long wanted something like INSTA."
"Our men proud of their increased production with INSTA."
"Precision work fast."
"Rejects cut to bone."

Miraculous NEW

INSTA COOLANT CUTTING COMPOUND

TRADE MARK REG

The "Ingredient X", a newly discovered wonder-worker, compounded in the base, actually eliminates static electricity — the cause of heat in metal-to-metal contacts. Particles of metal do not build up on the tool causing excessive tool breakage and wear. Tool and metal expansion greatly reduced. Result — precision machining.

PROOF— Make this simple and convincing test in your own shop. Select a turret lathe from which turnings are blue or brown. Push coolant spout to one side. Apply INSTA from bottle in generous quantities directly to tool point. THE TURNINGS WILL IMMEDIATELY TURN THE SAME COLOR AS THE METAL FROM WHICH THEY ARE BEING CUT AND WILL BE COOL.

GET THIS GENEROUS SAMPLE

The tremendous volume of requests for INSTA has forced us to make a small charge of $2 postpaid for generous sample. Complete satisfaction or money back.

Write or wire for quantity price and full information. Prompt shipments.

The FINEGAN-CAMPBELL COMPANY-Dept. 254
INTERNATIONAL SALES
1016 BALTIMORE - - - KANSAS CITY 6, MO.

cutter will be found very efficient for straddle milling work, and very smooth in cutting action. **961-K**

D-M-E MOLD STANDARDS are presented in a revised edition of the Detroit Mold Engineering Company's catalog. A number of items have been added which are very useful in building compression and injection molds. A complete set of their master layouts is recommended for reducing engineering time to an absolute minimum. The D-M-E Mold Bases have many advantages and are designed to fit all standard molding machines. **264-K**

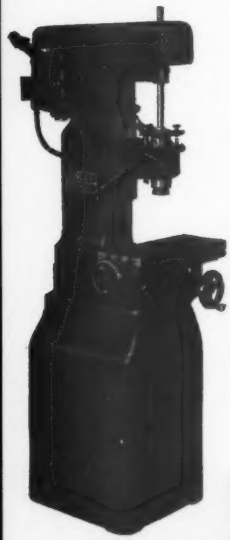
INDUSTRIAL GIANTS—Lathes and their accessories are presented in a colorfully illustrated catalog entitled "America Sings," published by R. K. LEBLOND MACHINE TOOL CO., Dept. T, Cincinnati, O. All types and sizes of guns from 20 mm to 5.5" bore may be accurately bored, drilled and reamed on their specialized lathes. Their versatile accessories multiply the natural wide scope of the lathe many times. Thirty-eight special rests, individual tool posts, turrets and automatic stops are provided for all manner and type of jobs. **359-K**

"AMPCO METAL IN MACHINE TOOLS", is the title of an interesting bulletin published by AMPCO METAL, INC., Dept. TD-3, Milwaukee 4, Wis. Ampco Metal is a copper, high aluminum, high iron alloy, made in six grades of graduated physical properties. 65 different applications of Ampco Metal in just one machine tool line are obtainable. In many places this metal lasts from three to five times as long as ordinary bronzes. Its long life through resistance to wear from mating parts is important as it assures maintained accuracy without backlash in gearing or sloppy bearing fits after the "newness" has worn off the machine. **956-K**

CARBIDE CUTTING TOOLS—Specifications and a supplementary sheet of Do's and Dont's for users of Carbide Cutting Tools are available from the CARBIDE TOOL ENGINEERING CO., Dept. T, 4439 Lincoln Ave., Chicago, Ill. The list of Do's and Dont's is of pertinent and daily interest to the mechanic interested in getting the maximum performance from his carbide tools. The list gives proven tips on such subjects as vibration elimination, correct positioning, tool holders, overhang, cooling, grinding, chatter, wear, tool life, etc. Information on Carboil, a liquid lapping lubricant, essential to efficient diamond grinding of Tungsten and Tantalum Carbides is also available. It contains no abrasive and may be successfully applied to both composition or metal backed diamond wheels. **966-K**

HAND CUT ROTARY FILES for use on flexible or stationary shaft filing machines, portable electric, air tools and similar devices are

SMALL WORK ON A SMALL MACHINE



Saves TOOLMAKERS' TIME

The hours expended in trying to fit small, tricky toolmaking jobs to large capacity machines run costs beyond reason. For better, faster set-ups, rapid changeover and assured profits we suggest your investigation of the LINLEY machine.

HIGH SPEED VERTICAL MILLING and JIG BORING . . . DIES, PATTERNS, MODELS

. . . and many other tooling jobs can be scheduled for the Linley with full confidence in its accuracy . . . its ability to earn its keep.

***FEATURES* include: 8 spindle speeds to 4250 r.p.m.; velvet feed; direct micrometer setting; grease sealed bearings; no backlash in quill travel; table size 7" x 17½"; floor space 18½" x 20".**

Bulletin on request

LINLEY BROTHERS COMPANY
642 STATE STREET EXTENSION
BRIDGEPORT, 1, CONN.

TO HELP YOU DO BETTER WORK *Faster!*

AMERICAN HOLE CHECKERS

AMERICAN BENCH CENTERS

AIR-OPERATED HOLE CHECKER—Checks inside diameters to ten thousandths. Quickly determines size, taper, bell-mouth and out-of-round condition. Specially designed sizing plugs are made for your production parts. Can be used on any number of hole sizes by simply changing plugs.

The American Hole Checker is operated by controlled air pressure and volume. Dial can be calibrated so that graduations register 0.0001".

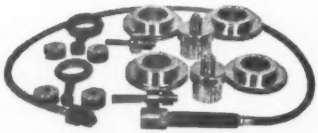
IMPROVED BENCH CENTER—Three sizes: for checking work up to 4" dia. x 10"; 6" dia. x 24"; and 8" dia. x 36". Additional diameters possible by use of raising blocks.

Adjustable heads easily slid into position. Clamping levers hold heads in adjustment. Retracting lever permits quick removal of work. Special large size center fixtures and bull centers for checking practically any diameters.

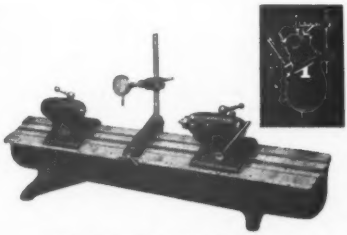
Box-type bed supported on three legs, always sits solidly on bench. Bed inclined 30° to facilitate handling of work and prevent its misuse as "catch-all". Indicator bracket and holder carries a 0.0001" dial indicator and is readily adjustable to all positions.

Send for Bulletin 43-TDJ. Get data and prices on American Hole Checkers . . . Bench Centers . . . Thread Checkers . . . Radius Dressers . . . Amplifying Gages and Lapping Plates. Your inquiry solicited on special Tools, Dies and Fixtures.

Checks holes without actually contacting inside surfaces. Eliminates possibility of scratching or damaging soft or burnished hole surfaces.



Flexible hose connection and various types of sizing plugs for use with Hole Checker. Finest precision workmanship.



Note convenient working position at Bench Center.

THE AMERICAN GAUGE CO.
125 Bayard St. DAYTON 1, OHIO

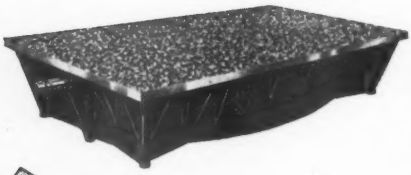
presented in a 6-page illustrated folder obtainable from HELLER BROS. CO., Dept. D, Newark, N. J. An addition to its regular line of Nucut American and Swiss Pattern Hand Files, these power-driven rotary files are obtainable in flame, ball, cone, tree, oval, cylindrical, tapered and other shapes recommended for the fast cutting of hard metals. Each shape is available in a number of sizes, as well as in rough, coarse, fine and smooth cuts. **747-K**

"SPRING-LIFE" BELLOWS—their construction and engineering advantages are featured in a new illustrated Catalog, BG-2-15, released by the COOK ELECTRIC CO., Dept. J, 2700 Southport Ave., Chicago 14, Ill. These bellows are particularly suitable for applications requiring extreme accuracy in spring-rate as well as zero hysteresis. The Cook "Thermal-Aire" Bellows Switch is designed for use in applications where extreme sensitivity is demanded and can be operated by air, gas, steam, water or other fluids. The catalog also depicts the services and products of the new Cook subsidiary the "MetaLastic" Division, established to handle specialized production problems. This catalog is supplied to all executives, purchasing agents and engineers when requested on a company letterhead. All other requests will be filled at a charge of sixty cents per copy. **964-K**

PNEUMATIC SANDER suitable for either wet or dry sanding is illustrated and detailed in a 4-page folder issued by the SUNDSTRAND MACHINE TOOL CO., Dept. T, Rockford, Ill. The high speed (3500 pad oscillations per minute) of this 6-lb. machine permits use of heavier grit abrasives than is practical with hand sanding methods and consequently lessens the loading of the abrasive and increases the cutting efficiency. Its opposed reciprocation of pads and balance of moving parts eliminates fatiguing vibration so that the operator can freely and rapidly move the machine over large surfaces. This Sundstrand Model 1000 Sander with its numerous pad attachments can be adapted to practically any sanding operation whether the surfaces are large or small, curved or flat, of Wood, Metal, Plastic or Composition. **36-K**

FOLDING LADDER—A heavy-duty, lightweight type "G" folding ladder which folds into a bundle 3" x 3" is illustrated in a circular issued by the DUO-SAFETY LADDER CORP., Dept. TD, Oshkosh, Wis. A special lock keeps the ladder absolutely rigid in the open position. Its famous Duo-Safety Safety Shoes provide maximum safety while working on all types of surfaces. A list of specifications is included. **959-K**

SMITH MASTER
SURFACE PLATES



If your inspection demands surface plates of highest precision, follow the lead of outstanding aircraft and ordnance plants everywhere. Plates produced by the superior Smith process are accepted as standard for close tolerance work. Many standard sizes available for immediate delivery. Write, phone or wire for prices and delivery.

LAPPING AND PLANER - FINISH PLATES ALSO AVAILABLE

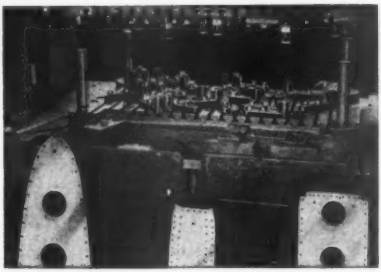
SMITH TOOL & ENGINEERING CO.
858 N. Sandusky Ave. Bucyrus, Ohio

YOU COULDN'T ASK FOR ANYTHING MORE SIMPLE — OR BETTER THAN

WHISTLER ADJUSTABLE PUNCH and DIE UNITS

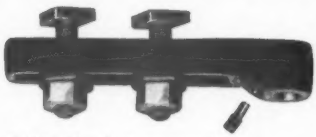
Whistler Adjustable Dies work on any type press and because of their simplicity even new workers quickly learn to make pattern change-overs—increasing productive press hours. Absolute precision on short or long runs. Whistler design permits more perforations in a given area—often reducing press operations.

For quick and complete information on the advantages of Whistler Adjustable perforating and notching dies send a description or drawing of your work.



These pieces produced with Whistler Adjustable Dies clearly illustrate the re-use of same punch and die units.

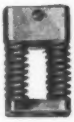
These photographs show the simplicity of a Whistler Adjustable Punch and Die assembly. Every piece is interchangeable.



Self-locking bolts on punch holder drop into T slots of die shoe. Set-screw engages into recess at base of punch. Punch cannot turn or pull out in operation.

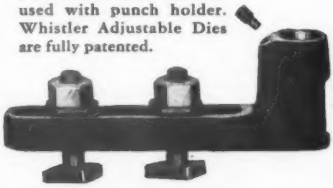
Punches of finest tool steel are machined to .0001" tolerances.

Stripper unit fits smoothly over punch—no "wobble". Flushed set-screw engages into groove on punch body. Stripper or punch quickly removed when desired.



Grooved heads on dies make lifting from holder quick and easy. Like the punches, dies are held firmly into holder by set-screw in recess at base. Whistler *precision* is known the world over.

Die holder has self-cleaning slug chute. Special design bolt heads present two bearing surfaces to T slot channel—self-locking, same as used with punch holder. Whistler Adjustable Dies are fully patented.



Write for the Whistler Catalog—every Production Executive should have it.

S. B. WHISTLER & SONS, Inc.

Over 25 Years of Tool and Die Making Experience

752-756 MILITARY ROAD BUFFALO, N. Y.

DEVLIEG JIGMIL

No. 3-A
3" BAR

To more accurately and speedily serve the broad field needing a machine having

• • •

THE SPACING ACCURACY OF A JIG BORER

• • •

THE PERFORMANCE QUALITIES OF A MILLING MACHINE

• • •

THE CONVENIENCE AND FLEXIBILITY OF A HORIZONTAL BORING MILL

A PRECISION MACHINE

Featuring

NEW SPEED OF OPERATION

NEW ADVANCED FINGER TIP CONTROLS

NEW STANDARDS OF EXCELLENCE OF BORED HOLES

NEW ACCURACY IN MILLING

AUTOMATIC TABLE RETRACTION AND REPOSITIONING

Many machines in operation show 75% greater average daily productivity and improved dependability for precision.

Write for Circular

DEVLIEG MACHINE COMPANY
452 FAIR AVENUE, FERNDALE (DETROIT), MICHIGAN

DEVLIEG MACHINE TOOLS

SHOP AIDS

and BOOK REVIEWS

MATERIALS HANDBOOK, 5th Edition, Revised, Enlarged, by George S. Brady, Formerly Managing Editor, Product Engineering; Formerly Technical Adviser to United States Coordinator for Industrial Purchasing.

This book puts the engineer and executive in command of a vast store of constantly useful information—a short cut to accurate, essential facts needed in the selection and specification of materials. With this book at hand you can save time in seeking materials for new products or processes and in checking your requirements for new or improved materials that may fill them better. It assembles the most pertinent and important facts to enable you to make quick comparisons, avoid checking many sources and remote possibilities, get quickly to the few materials best suited to a specific purpose. More than 6650 materials are covered—metals, woods, industrial fabrics, chemicals used in industry, abrasives, building materials, useful minerals, ceramics, paints and finishing materials, resins and molding materials, etc.; many more processing materials used in the basic and intermediate industries have been included. Each material is covered with regard to relative quality, composition, strength, weight, or whatever other facts are necessary to give a quick, practical, and authoritative picture of the place of the material in industry.

The keynote of the book is accuracy, authority, and correct nomenclature. For years, even preceding the first edition in 1928, the author has been collecting, sifting, and classifying information to get that most workable and valuable for materials users and purchasers. In doing so he has had access to the specifications of large manufacturers, the Federal Specifications Boards, the American Society for Testing Materials, the Society of Automotive Engineers, and other sources.

Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y., and priced at $5.00.

HANDBOOK ON DESIGNING FOR QUANTITY PRODUCTION—Prepared and edited by Herbert Chase.

It is the purpose of this book to provide engineers, engineering students, and others interested in design with as much practical information on designing for quantity production as can well be compressed within a volume of this size. The authors of the various chapters are or have been intimately associated with work involving their respective subjects and are ranked as authorities on these subjects. They are not only familiar with the latest methods of production but are in frequent contact with shops that employ high-production methods as well as with other engineers engaged in design for production in large quantities. They know well what designers of items intended for production by the methods dealt with should do and should avoid doing if the parts designed are to be produced to best advantage.

Written by seven authors, each one an expert, this book gives a completely practical treatment of the design of basic parts for quantity production by die casting, sand casting, screw machine, stamping, die forging, hot and cold heading and plastic molding. Along with full explanations of the various high-production processes and sound pointers on designing for each one of the processes, Part I of the book gives many specific rules, amply illustrated to show their practical applications, for designing products that will lend themselves to rapid and economical mass production. In Part II various types of products manufactured in quantities at moderate or minimum cost are compared, one against the other, in many instances with actual production costs and tabular comparisons, to show the type of design best adapted for economical manufacture in various specific instances.

The comprehensive coverage of the book is best indicated by the chapter titles: Part I, Design of Die Castings, Design of Sand Castings for Quantity Production, Design of Screw-Machine Products, Design of Stampings, Design of Die-Forged Parts for Quantity Production, Notes on and Accomplishments in Hot Heading, Notes on the Design of Cold-Headed Parts and Design of Plastic Moldings for Economical Quantity Production; Part II, Die Cast or Sand Cast? Permanent-Mold and Die Castings Compared, Which Type of Nonferrous Casting? Die Cast or Stamped? Die-Cast or

Screw-Machine Products? Cold-Headed or Screw-Machine Products? and Die Castings and Plastic Moldings Compared.

Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. $5.00.

WELDING INSTRUCTIONS, for use by Welding Supervisors, Leadermen, etc., of all crafts concerned with shipyard welding. For many months shipyard training and production departments have been searching for material that could be used with confidence in training the members of the welding, ship fitting, and other concerned departments in the proper welding techniques to be used on the ship from keel laying through to delivery of the vessel. The material contained in these instructions has been gathered from the experiences of a representative body of men active in merchant and naval shipbuilding, and from the records of common failures encountered on ships during the construction period and attributable to welding procedure. This group has worked in cooperation with the United States Maritime Commission and the American Bureau of Shipping, both of which have approved the material for use in training shipyard supervisors and craft employees concerned with welding.

Published by: U. S. Maritime Commission, Washington, D. C.

TRAINING TEAMWORK—a 12-page pamphlet describing how management and labor have worked together in joint in-plant training committees to deal specifically with apprenticeship as well as short-term training programs. This joint participation in training, which is a generally accepted policy today throughout industry, is exemplified by a description of joint committees in action at Manitowoc Shipbuilding Corp., Skagit Steel and Iron Works, General Mills, Inc., and Belmont Radio Corp. Reference is also given to a list of bulletins and reports on the subject which are available.

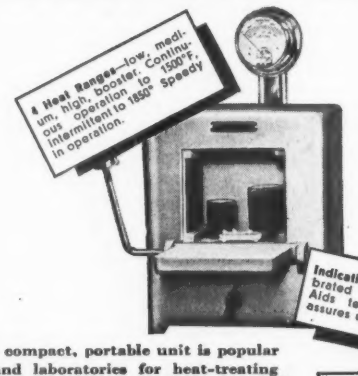
Copies of this pamphlet may be obtained by writing to Apprentice-Training Service, Bureau of Training, War Manpower Commission, Washington, D. C.

WELDING INSTRUCTION FILMS—The Welding Equipment & Supply Company of Detroit has prepared in collaboration with the Jam Handy Organization a sound slide film program involving two separate films, with their accompanying recordings, which show the metallic arc welding of tools and dies. It is the only program of its type that has ever been prepared in this connection and covers a subject that has not been delved into to any great extent by manufacturers of welding rods because it is a highly specialized phase of welding. The material contained in this program is the result of experimentation and

FOR SHOP and LABORATORY

CHOOSE TEMCO!

The Compact Electric Furnace with Many Uses


4 Heat Ranges—low, medium, high, booster. Continuous operation to 1500°F. Intermittent to 1850° Speedy in operation.
Indicating Pyrometer—calibrated in Fah. and Cent. Aids temperature control, assures uniform results.

THIS handy compact, portable unit is popular in shops and laboratories for heat-treating and many other jobs. Expertly designed and built, "it's a lot of furnace for a low cost."

Write for details today.

$42.50 (Complete for 115 volts) ($5 extra for 230 volts)

Dimensions—Inside, 4" wide, 3¼" high, 3¼" deep; outside, 9" wide, 14" high, 10" deep.

THERMO ELECTRIC MANUFACTURING CO.

474 West Locust Street .·. Dubuque, Iowa

SAVE PRODUCTION TIME

with a SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 54" above floor and lowers to within 5½" of floor. Overall height 72". Size of platform 24"x24" wood deck. Crank, up and down, hoist unit.

ECONOMY ENGINEERING CO.
2659 W. Van Buren St., Chicago, Ill.

Price **$147.50**

IMMEDIATE DELIVERY

developments over the past eight years which have given the Welding Equipment & Supply Company engineers sufficient knowledge of this phase of welding to be able to set up very pertinent facts in connection with the advantages to be secured by the proper application of tool steel welding electrodes.

Part No. 1, entitled "Let's Get The Low Down", is the story of Eureka tool steel welding electrodes and deals with the products themselves. This opens with a story of a typical breakdown in a plant and shows how a bottleneck in production was eliminated.

Sequence No. 2 deals with certain facts found in the development of metallic arc welding tool steel electrodes, and the place the developments have found in industries, as well as how this specialized field of welding can be adapted in planning tool and die programs.

Sequence No. 3 deals with the number of different brands of tool steels on the market, and breaks them down into their various typical classifications. In this sequence is brought out the development of electrodes for use on each classification of tool steel.

Sequence No. 4 answers many typical questions that are paramount in the minds of plant personnel in connection with tool steel welding and the answers to same. Sequence No. 5 deals with testimonials in connection with the benefits derived in this specialized field of welding and also cites and portrays typical samples of jobs done with the process.

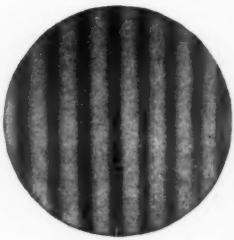
Part No. 2 of the program is entitled "Let's Do It Right", and covers the proper application of Eureka tool steel welding electrodes. This part deals entirely with the proper application of metallic arc welding tool steel electrodes, breaking down each of the different steps in the sequence necessary to the proper application of these types of rods.

This program can be exhibited to plant personnel through Welding Equipment & Supply Company's distributor organization throughout the United States or the films and recordings can be purchased at a nominal fee for use in plant training programs. They are also available for use by educational institutions.

HARD CHROMIUM PLATING which improves working surfaces of tools, dies, gages and various parts used and manufactured by shipyards and aircraft, automotive, ordnance and ammunition plants is the theme of a 4-page bulletin published by MIDDLESEX GAUGE & TOOL CORP., Dept. D, 526 W. 48th St., New York 19, N. Y. Hard Chromium Plating being a cold process does not cause internal distortions in parts treated; and is invaluable in the salvaging and reclaiming of worn and hard-to-replace parts. **963-K**

Determine Surface Flatness to Millionths of an inch with

ACME OPTICAL FLATS



★ **Deviations from absolute flatness can be quickly and easily determined in millionths with the aid of Acme Optical Flats and Monochromatic Lamp.**

Illustration shows interference bands reflected from a truly flat surface as they are seen through an Acme Optical Flat. The straightness of the bands determines the flatness of the surface.

Our new booklet, "Shop Measurements to One Millionth of an Inch", describes in simple detail how light waves are used to measure in micro-inches.

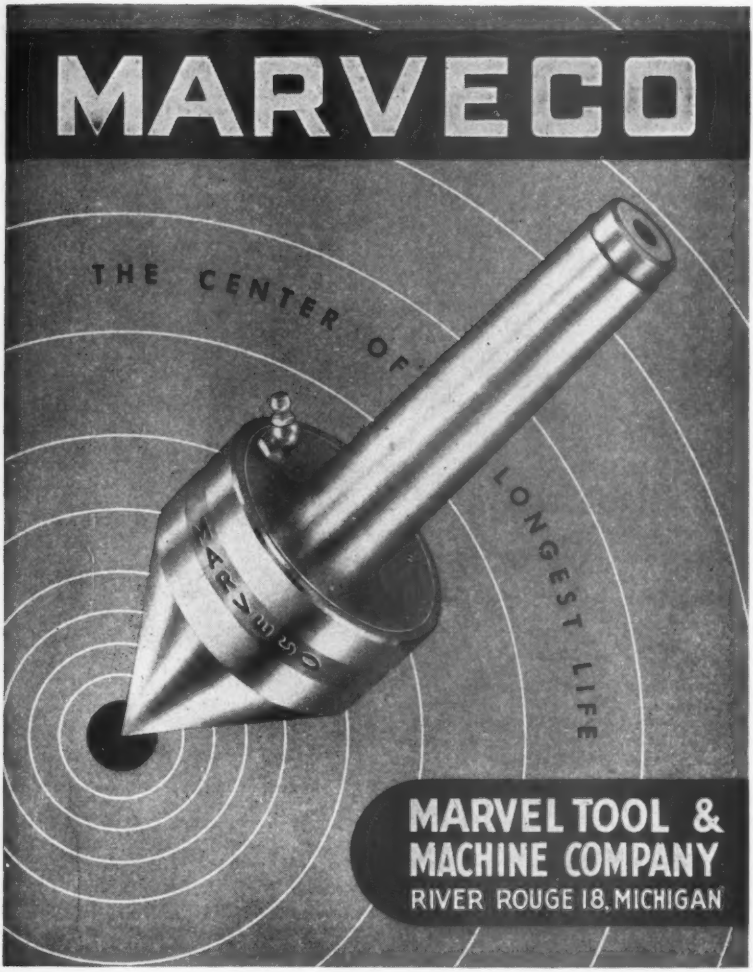
... or a copy today . . . it's yours for the asking.

ACME INDUSTRIAL COMPANY

Makers of Standardized Jig and Fixture Bushings

206 N. Laflin St. Chicago, Ill. MONroe 4122

MARVECO

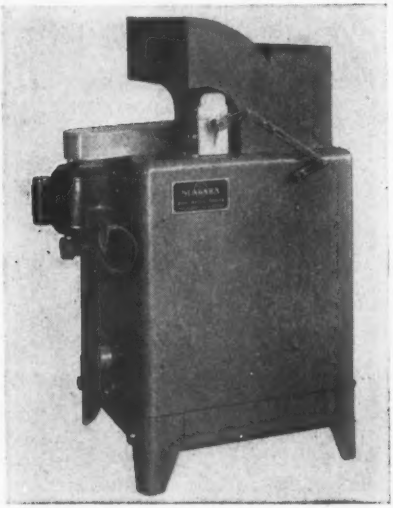


MARVEL TOOL & MACHINE COMPANY
RIVER ROUGE 18, MICHIGAN

The **MARVECO** *Live Center* (formerly the Marvel)
is guaranteed to outperform any other live center made.
Write to 10973 W. Jefferson, River Rouge 18, Michigan
for NEW CATALOG

SEND US YOUR PROBLEMS

Keeping Water and Oil Out of COMPRESSED AIR



NIAGARA Aero AFTER-COOLER
U. S. Patent Nos. 2,321,933
and 2,296,946
Other Patents Pending

● Controlled temperature cooling with the NIAGARA AFTER-COOLER excludes excess water and oil from compressed air lines, preventing damage to pneumatic tools and harm to materials on which compressed air is used — as in the cleaning of metals by air blast or steel shot.

The NIAGARA AFTER-COOLER condenses the moisture before it gets into the lines and helps produce compressed air containing only ½ to ¾ as much moisture as air cooled by conventional equipment. At the same time it saves 95% of cooling and jacket water cost, quickly paying for itself. Write for complete information.

NIAGARA BLOWER CO.
25 Years of Service in Air Engineering
Dept. TD-54, 6 E. 45th St., New York 17, N.Y.
Field Engineering Offices in Principal Cities

NIAGARA
AIR ENGINEERING EQUIPMENT

Binocular Headband Magnifier

The Binocular Headband Magnifier, designed for high precision work or inspection, is interesting both from its optical characteristics and because of its molded material.

Introduced by Carl Zeiss, Inc., 485 Fifth Ave., New York, N. Y., the Magnifier is fitted with optically ground lenses of prismatic shape to prevent eyestrain. The magnification is about 2¼ times with a large and clear field of view. Irregularities in a product being inspected are quickly and easily found. Setting up work that requires precision

reading of instruments or accurate locating or positioning is simplified. No focusing is required and at the free working distance of 8 to 10 inches, the Magnifier can be worn continuously and over eye glasses when necessary.

The Headband Magnifier is molded of black Tenite. This thermoplastic material is a product of the Tennessee Eastman Corporation, Kingsport, Tenn. Light in weight, non-inflammable and shatterproof, the eyeshield and headband are comfortable to wear. The headband is flexible and adjustable by a lock screw. The design of the Magnifier permits an unobstructed view by raising the head slightly so that normal activities may be conducted without removing the Magnifier. 954-K

ZOOM PRODUCTION!
SLASH COSTS!

with "Airgrip" Double-Action Devices

"AIRGRIP" CHUCKS

YOUR judgment will be doubly vindicated when you invest in "Airgrip" Chucks — (1) *Immediately*, because your output records will rise — 25% and more — and your manpower problem will be eased; (2) *Later On*, because the unit-cost-cutting achieved with these improved, lathe-modernizing chucks will enable you to meet returning competition.

"Airgrip" Chucks offer "two-fisted" double gripping power because of the cam's wedge action (which operates in both directions) and locks the jaws *mechanically*, whether gripping internally or externally.

Work is held tight even if air supply is cut off completely.

Both the two-jaw and three-jaw "Airgrip" Universal Chucks permit using heavier cuts and coarser feeds to the very limit of the machine's power and cutting-tool endurance.

"AIRGRIP" REVOLVING AIR CYLINDERS

Double-acting ball-bearing, high-speed revolving air cylinder with maximum life and minimum maintenance. No manual adjustments required. Wear automatically taken up by air pressure within the cylinder.

HI-PO SUPERCHARGED HYDRAULIC PRESSURE PUMPS

3000 lb.-Pressure Pump, driven by a ½ h. p. motor! *Double-Pressure Production;* consists of a low-pressure section which *supercharges a high-pressure section.* Builds up pressure fast, with minimum pulsation.

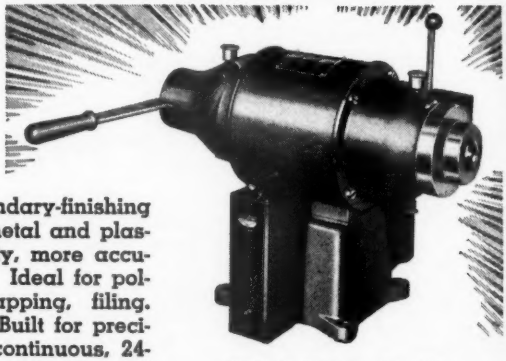
WRITE US FOR BULLETIN, AND CONSULT ANKER-HOLTH ENGINEERS ON PNEUMATIC OR HYDRAULIC APPLICATIONS

Anker-Holth Mfg. Co.

532 S. Michigan Ave. Chicago 4, Ill.

Cleared and Issued Through Facilities of the Office of War Information
WPB 5447 Moore 76247

IDEAL SPEED LATHES



are performing secondary-finishing operations on small metal and plastic parts—more quickly, more accurately, at lower cost! Ideal for polishing, de-burring, lapping, filing. Quality engineered. Built for precision performance in continuous, 24-hour-per-day service! A size and type for every purpose.

Write for Catalog No. 440.

ARMY E NAVY
AWARDED
October '42

SCHAUER MACHINE COMPANY
ORIGINATORS OF TODAY'S SPEED LATHES
2078 READING ROAD ··· CINCINNATI 2, OHIO

Extensive field tests prove that this new Vitrified Diamond Hand Hone—a strictly Norton development—has these advantages:

1. **Up to 50% faster cutting action** than resinoid type hand hones—and even more compared to metal hand hones.
2. **Up to double the life** of resinoid hand hones for the same depth of diamond section.
3. **Few dressings required.** Metal diamond hones tend to dull and must be dressed frequently.

Available in stock in two types: diamond section one end—320 grit; diamond sections both ends—320 grit and 400 grit. Call your Norton distributor or Norton abrasive engineer.

NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

W-961

NORTON ABRASIVES

● Cold processing and dual temperature applications with Kold-Hold Sub-Zero Industrial equipment include shrink fits, stabilization, aging and hardening of metals, processing and storing of aluminum rivets and sheets, pitch removal from optical lenses, testing of gauges and materials used in airplane manufacture. Numerous other applications are military secrets. . . . The flexible, economical and dependable performance of Kold-Hold machines merits investigation. . . . What's your individual problem? Catalog Z-S 431 furnishes many ideas about uses and ranges of Kold-Hold equipment. Write today.

KOLD-HOLD
MANUFACTURING COMPANY
Productioneered for Industry
445 North Grand Ave., Lansing 4, Michigan

New Hand or Bench Type Gage

A new comparator type roll snap gage which can be used either as a hand or bench type gage is of interest to industry generally and to automotive and aircraft manufacturers specifically, where gaging external diameters up to 1" is necessary in large production. A 250 to 1 magnification is offered for gaging parts with a .004 tolerance or less; and magnification of 150 to 1 for parts with greater than a .004 tolerance.

It is made in six nominal sizes (¼, ⅜, ½, ⅝, ¾ and ⅞-inch); each size being adjustable ⅛" either way from the nominal size. Accordingly, thread diameters from No. 6 to 1" can be gaged within the group of gage sizes. Rolls are

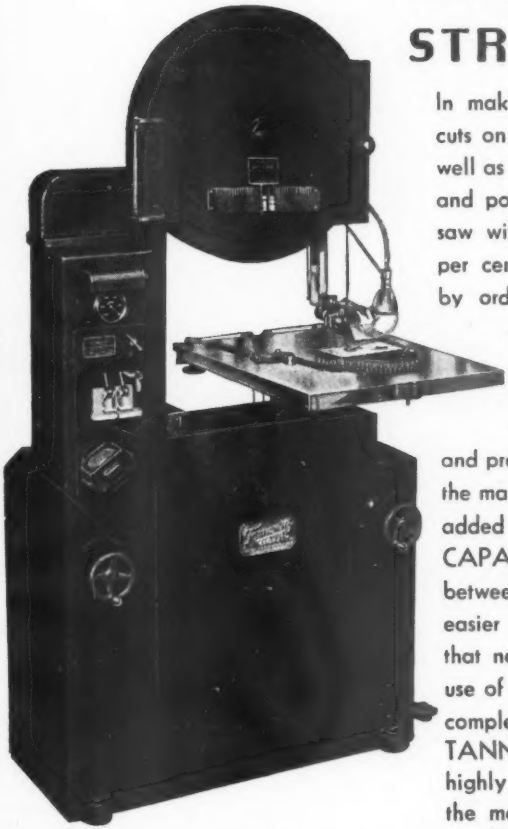
provided in ⅜", ⅝" and 1" widths.

It is manufactured with both plain and threaded rolls. Different pitch rollers are interchangeable and one set of rollers may be replaced in less than five minutes. To set the Limitrol it is merely necessary to place a master between the rolls and turn an adjusting screw on the bottom of the gage until the indicator arm moves up under the proper limit bar. The Limitrol is easy to operate and is available in both open and closed end models.

N. A. Woodworth Co., Sales Div., 1300 E. Nine Mile Rd., Detroit 20, Mich., will send Catalog No. 44L. 926-K

Tannewitz DI-SAWS

have LARGER CAPACITY, saw *Easier*, STRAIGHTER



In making inside and outside cuts on dies, tools, jigs, etc., as well as inside and outside filing and polishing, the modern die saw will save upwards of 70 per cent of the time required by ordinary methods and reduce costs proportionately. Don't overlook this great opportunity to step up both production and profits. But be sure to get the machine that gives you the added advantage of EXTRA CAPACITY (a full 24 inches between the blades) and the easier and straighter cutting that naturally follows from the use of larger wheels. Get the complete facts concerning the TANNEWITZ M-24, the most highly developed die saw on the market. Simply write for our DI-SAW Bulletin. Also describes larger DI-SAWS for special applications.

Other bulletins on request: Single and Variable Speed Foundry Band Saws; SHEET METAL CUTTING Band Saws.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

Our Purpose

TO HELP YOU PRODUCE A FINER PRODUCT . . .

This can be done only by controlling the size of threaded holes, screws and studs with quality gages.

No matter what thread form the product calls for, we are ready to furnish you with finest quality gages in sizes from 0-80 up to and including 6⅝" O.D.

Our gages, made from the finest tool steels, are scientifically ground and carefully lapped, thus assuring you gages which last longer.

Specify Gages by Republic Gage

REPUBLIC GAGE

2228 FENKELL AVE. DETROIT 21, MICH. PHONE UNiversity 1-0370

New Laboratory Furnace

A new Combustion Tube Furnace, the CF-1, for laboratory use is announced by Lindberg Engineering Company, Dept. T, 2444 W. Hubbard St., Chicago 12, Ill. Designed for fast and modern carbon and sulphur determinations as well as gravimetric determination of carbon and all alloy steels including stainless and heat resisting steels, the single tube CF-1 Furnace provides temperatures for continuous operation up to 2500° F and for occasional operation up to 2650° F.

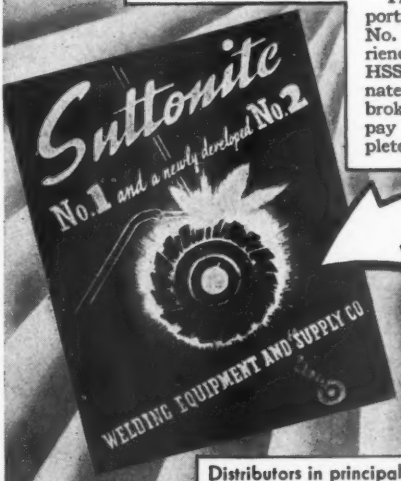
The new furnace combines utility and stream-lined design. High temperature Globar elements are easily installed or removed without total dismantling and assembly of the unit. All necessary controls are conveniently located on the face of the furnace. Coarse and fine adjustment knobs connected to a built-in variable voltage transformer provide accurate temperature regulation. An ammeter records the proper and safe current required for the Globar heating elements; a pyrometer connected to a platinum thermocouple indicates the furnace temperature. The flow of oxygen is knob controlled by a needle valve connected to rubber tubing adapters at both ends of the housing. A line cut-off switch and signal light which shows when the furnace is operating complete the controls. Three adapters for interchangeability of 1", 1¼" and 1½" OD standard combustion tubes are provided. The 2" OD tube can be used without an adapter. **369-K**

NOW you can RECLAIM HIGH SPEED STEEL TOOLS by WELDING right in YOUR OWN PLANT!

with Suttonite No. 1 AND A NEWLY DEVELOPED No. 2

The Welding Equipment & Supply Co. (originators of "SUTTONIZING", the first successful welding process for reclaiming HSS Tools) announce their recent development of SUTTONITE No. 2 Drawn Alloy Welding Rods, which with SUTTONITE No. 1 now make it possible for you to reclaim your high speed steel cutting tools by welding right in your own plant.

This announcement is of vital importance for, with SUTTONITE No. 2 the customary hazards experienced in the welding of broken HSS cutting tools has been eliminated. If you want to repair those broken tools in your plant it will pay you to wire or write for complete information today.



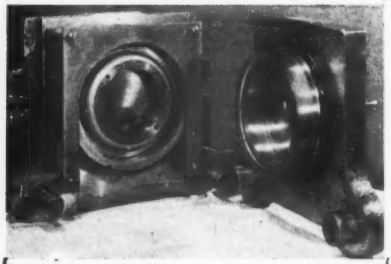
★ Here's the booklet that tells all about SUTTONITE No. 2 and how to use it in your plant. Don't fail to send for it today!

Distributors in principal cities of the United States and Canada.

WELDING EQUIPMENT & SUPPLY CO.
223 LEIB STREET • DETROIT, MICHIGAN

and *Save*

1. Time
2. Money
3. Manpower
4. Metal



THIS DIE IS MADE OF
4 TOOL STEEL TUBES

The blanking and drawing die shown above was made of BISCO tool steel tubing at a fraction of the cost of forging rings or boring solid bars. Why not let us give you more information on this subject?

SEND TODAY FOR THIS FOLDER

BISCO

THE BISSETT STEEL CO.

945 EAST 67th ST., CLEVELAND 8, OHIO

Matthews "Sure-Set" Holders

The "Sure-Set" Holder, for setting up parts numbers and other markings which require a single line of characters, and which is machined from a single piece of acid resisting plastics material, is announced by Jas. H. Matthews & Co., Dept. TD, 3942 Forbes St., Pittsburgh, Pa. Designed to fill a need created in the aircraft, automotive and other metal working industries by the development of this company's "S-22" Synthetic Etching Type and Logotypes, the Holder replaces band stamps, ordinary friction type holders or individual hand stamps.

The slotted construction at the face of the holder permits insertion of rubber or synthetic type without bending or distortion, the taper toward the face giving a free view of the type; this is particularly helpful when marking in restricted areas. A knob adjuster loosens or tightens type in the holder, applying the most efficient pressure for each marking job. Of particular importance is the ability of the Holder to use small characters down to $\frac{3}{64}$" with closer spacing than possible with ordinary band stamps. Special designs such as logotypes, trade names or serial numbers can be supplied for use in the holder.

The "Sure-Set" Holder is available in three sizes to take characters from $\frac{3}{64}$" to $\frac{1}{2}$" on 12, 24 and 42 point body sizes. The "S-22" synthetic type and logotypes, with acid resisting synthetic face, have outlasted the best rubber or ordinary synthetic type by from three to four times in production. **50-K**

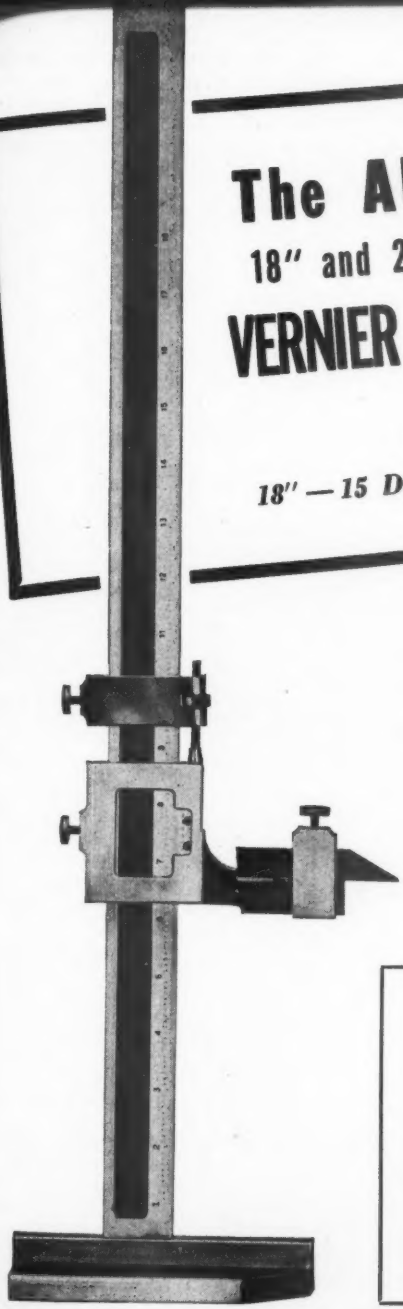
The AUTOMETRIC

18" and 24" English Measure

VERNIER HEIGHT GAUGE

Deliveries

18" — 15 Days • 24" — 30 Days



18" Vernier Height Gauge, Scriber and Case, F. O. B. Detroit,

$103.00

24" Vernier Height Gauge, Scriber and Case, F. O. B. Detroit,

$190.00

AUTOMETRIC CORPORATION

Manufacturers of

VERNIER HEIGHT GAUGES EXCLUSIVELY

10317 Northlawn Avenue

Telephone HOgarth 0410

Detroit 4, Mich., U. S. A.

Bearing Babbitt Segregation

Significant factspertaining to the control of segregation in babbitt were discussed during the presentation of a paper on this subject before members of the American Institute of Mining and Metallurgical Engineers at their recent meeting in New York City.

Prepared by T. E. Eagan and W. R. McCracken, metallurgists of The Cooper-Bessemer Corporation, Mount Vernon, Ohio, and Grove City, Pa., the paper dealt with the effect of temperature and other major factors encountered in the handling of two well known types of babbitt, one a tin-base and the other a lead-base.

Pointing out that lack of control in segregation can ruin the life of an otherwise good bearing made of perfectly good babbitt, the paper cited the results obtained in a number of tests conducted by authorities in this type of research.

During the discussion it was emphasized that "to recognize that babbitt is a cast metal will go far in controlling the segregation experienced in making a good serviceable bearing. Failure to recognize this fact has cost fabulous sums of money."

Commenting on the widespread method of static casting of bearings, it was stated that due consideration must be given in the designing of the metal backing against which the babbitt is cast.

"It has been the practice for many years to design the backing to meet the requirements of stress and fits," said Eagan. "Most of these backs are made of steel, iron or bronze which gives unlimited play to the ingenuity of the designer in making this shell act as a stress member instead of a backing to hold the babbitt. In consequence, dovetails are usually put in to hold the babbitt in place. Subsequent failure is usually attributed to poor babbitt or the wrong composition of babbitt, whereas, the real cause for failure can be traced back to segregation. Without the segregation, the babbitt would amply serve its purpose."

One simple solution, that in some cases has brought about a phenomenal improvement in the life and load-carrying ability of a bearing as explained by the authors, consisted of casting the babbitt on a

Knock-Out
UNIVERSAL TOOL GRINDERS
FOR FAST AND ACCURATE WORK ON MAINTENANCE OR PRODUCTION
MANY FIXTURES AVAILABLE
DELIVERY 15 DAYS
Did you know that approximately 90% of all tool and cutter grinders with a capacity of within 8" are KNOCK-OUTS?
Write for Bulletin No. 36-54
K. O. LEE CO. ABERDEEN, SOUTH DAKOTA

DOUGLAS *Precision* MACHINES

The Douglas Miller combines rigid, well balanced design with convenience of control making it particularly suitable for accurate work in tool room as well as for general production. It is available in plain or universal type.

Showing operation with Universal Milling attachment on tool room job producing a production fixture.

Showing operation with four cutters machining alloy steel for high precision aircraft parts

Prompt Delivery to War Plants

FOR TOOL ROOM AND PRODUCTION

The Rotorex Universal Tool and Cutter Grinder will accurately perform all kinds of tool grinding operations. Readily interchangeable attachments are available to set up machine for single-purpose jobs such as cylindrical, internal and radius grinding.

Operation showing set-up for internal grinding.

Operation showing set-up for sharpening straight gash hobs.

DOUGLAS MACHINERY CO., Inc.

150 BROADWAY • NEW YORK, N. Y.

separate simple cylinder of uniform cross-section, using it as an insert in the bearing cap.

Practical experience in the practice of cleaning and tinning bearing backs for Diesel engines and compressors produced at The Cooper-Bessemer plants was mentioned as being so successful that the dovetail type of design is being supplanted with those of uniform cross-section as fast as the drawings can be changed.

Babbitt pouring jigs, babbitt thicknesses and analysis of other vital factors in bearing construction were summarized and illustrated with photomicrographs of statically cast and centrifugally cast bearing cross-sections.

"The subject is exceedingly profound and complicated by many unknown quantities," said Eagan in his closing remarks. "To cover the many compositions of babbitt metal now on the market is not within the scope of this paper. However, if it brings to mind the fact that segregation is a major problem in the handling of babbitt metals and that considerable care must be exercised at all times, the main objective of the authors will have been accomplished."

Universal Centering Chucks quickly convert any medium-sized drill press into a centering tool. Work from screw machines that has been centered on one end can be set on the press and rapidly centered on the other. A feed adjustment regulates the depth of the center so that concentricity and uniform depth of centers are maintained.

A convenient arrangement is provided for quickly removing the center drill and guide bushings. Write for further facts.

UNIVERSAL ENGINEERING
FRANKENMUTH,
MICHIGAN

Atomic Vacancies Resist Rust

Vacant spaces in the atoms of nickel are responsible for its resistance to corrosion or "rusting," Dr. Herbert H. Uhlig, Metallurgist of the General Electric Research Laboratory, recently told the Electro-chemical Society.

In earlier researches, he found that the stainlessness of stainless steel is not due primarily to the formation on the surface of a film of oxide as formerly supposed. Instead, it results from the electron arrangement within the atoms of the alloy. Now he finds that the same thing is true for two other widely used corrosion-resistant alloys. One is copper and nickel (Monel) and the other molybdenum, nickel and iron (Hastelloy).

An atom may be thought of as a nucleus around which revolve, somewhat in the manner of planets around the sun, from one to 92 electrons. These move in from one to seven different orbits or shells. Ordinarily one shell is filled with electrons before the next one begins, though in the case of certain "transition" elements there are vacancies in the shell next to the outer one. In nickel, for example, there are only 8 electrons in the third shell, instead of the 10 it could hold, despite the fact that there

FOR *SPEED* AND *PERFORMANCE!*

Reciprocating Action (Push and Pull)

PORTABLE *Electric* TOOL

Mfg. by
H & H RESEARCH CO.
Detroit, Mich.

Used for . . .

- FILING
- HONING
- SCRAPING
- BURRING
- LAPPING
- SANDING
- CHAMFERING
- POLISHING
- SAWING

The reciprocating or "push and pull" action distinguishes this Portable Electric Tool from the rotary type of portable tools. Short forward and backward strokes enable the operator to perform accurately and speedily in tight corners and hard-to-reach or otherwise inaccessible places. Universal motor operates from any 110 Volt outlet and develops a 30 to 40 pound push-and-pull stroke at the rate of 1000 per minute.

Lightweight . . . weighing only five pounds . . . it is handled easily by man or woman.

Send today for specifications and details including complete assortment of accessories available for use with the Portable Electric Tool.

DELIVERY FROM STOCK

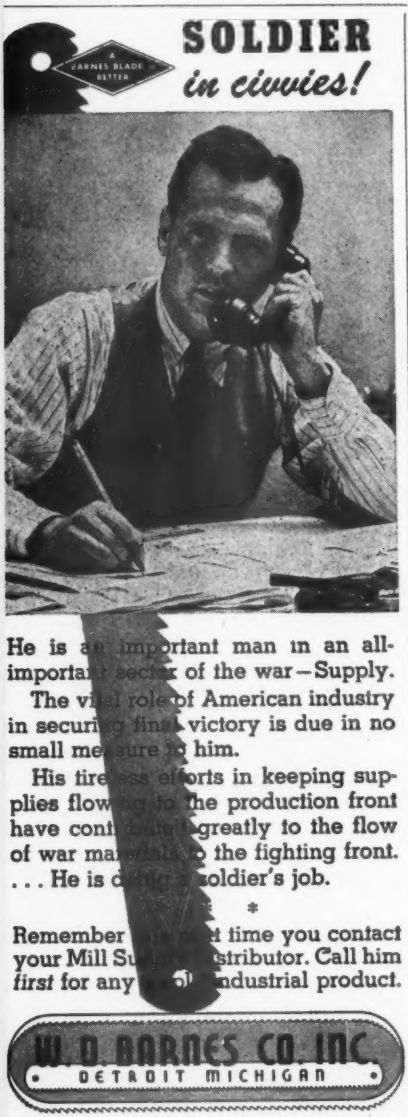
ACME TOOL COMPANY 196 CHURCH STREET NEW YORK 13, N. Y.

are two electrons in the fourth and outermost shell. With inner shells completely filled, a metal is more subject to corrosion.

Because of the vacancies, nickel is very resistant to corrosion but it is too expensive for many applications and so it is alloyed with copper which is lower in cost. The atom of copper has one more electron than that of nickel. In the alloy these extra electrons go to fill the vacancies in the nickel atom. However, as long as any vacancies remain in the nickel the alloy still resists corrosion as well as pure nickel.

Finally, when the proportion of 60 percent copper and 40 percent nickel is reached all the nickel vacancies have been filled. Further increasing the proportion of copper makes the alloy less resistant until pure copper is reached, which corrodes much more than pure nickel. In the alloy of nickel with molybdenum and iron a similar effect occurs, says Dr. Uhlig.

Vast quantities of valuable metals are lost annually by corrosion. Such studies as these are highly important because knowledge of the exact way in which corrosion occurs may lead to more effective ways of overcoming it.


A BARNES BLADE BETTER
SOLDIER
in civvies!
He is an important man in an all-important sector of the war—Supply.
The vital role of American industry in securing final victory is due in no small measure to him.
His tireless efforts in keeping supplies flowing to the production front have contributed greatly to the flow of war materials to the fighting front. . . . He is doing a soldier's job.
*
Remember the next time you contact your Mill Supply distributor. Call him first for any cutting industrial product.
W. D. BARNES CO. INC.
DETROIT MICHIGAN

Meehanite Casting Economy Experienced by Cooper-Bessemer

L. F. Williams, market research director of The Cooper-Bessemer Corporation, brought out some interesting facts concerning costs of certain Diesel engine castings made by the company as compared to welded structures in his paper delivered before the Meehanite Research Institute of America, Inc., at Cincinnati, Ohio, recently.

Mr. Williams' paper, entitled, "Relative Cost of Meehanite Castings Compared with Welded Structures in Diesel Engine Design", emphasized the tremendous production economies available in modern cast construction.

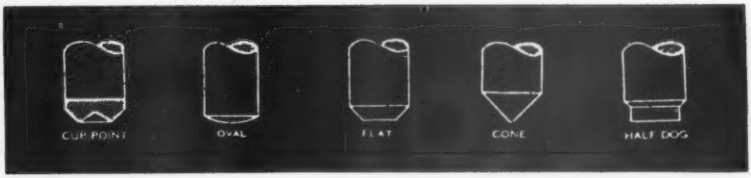
In presenting the background for cost comparisons Williams brought out how his company began a long-range program for improving their welding department in 1929.

"It was quite apparent then," he said, "that certain structures needed in our business could be produced more efficiently in a welding shop than in our foundries. This was and is true of jigs and fixtures and certain other special items where only short orders are re-

TOUGH But Not BRITTLE!

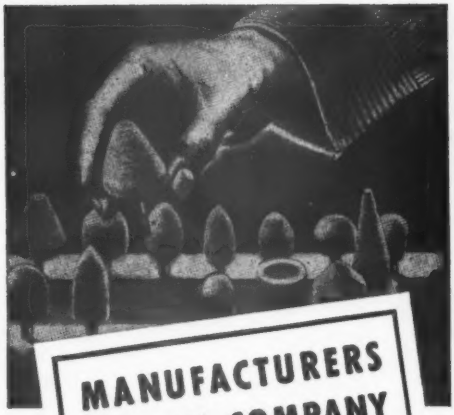
Safety SUPER-DUTY Set Screw

An unusually strong set screw with all threads die cut — class 3 fit. The sockets are accurately broached, clean and free from grit. The screw is made from special alloy steel, which has been heat treated for maximum toughness, with a tensile strength of 225,000 lbs. to the square inch. The Safety Super-Duty is furnished in any style point shown below.



NATIONAL GRINDING WHEELS

Pay for themselves with longer life, higher grinding speeds and fewer breakdowns. They are investments which pay big returns on production work. Mounted wheels for use in Pattern Shops—Die Shops—Foundries—Auto Body Plants—Plant Tool Rooms—Garages—Rubber Plants—Glass Mfrs.—Textile Mills—Potteries and Home Workshops.



MANUFACTURERS SUPPLY COMPANY
2640 CARNEGIE AVENUE
CLEVELAND, OHIO

quired. By 1937 this department contained all the machinery then available for efficient fabrication in small-lot quantities: brakes, shears, bending rolls, speed saws, manipulators, multi-torch pantographs, and the best obtainable acetylene and electrical welding equipment, including butt-welding and spot-welding machines. The shop was placed in charge of a man whose papers on welding subjects are heard with respect.

"We were so well pleased with the relative cost of single-lot welded items, that we began to develop fabricating costs on any production items that were giving trouble in our foundries. Whenever we made comparisons of this kind, we were not satisfied alone with data from our own fabricating department; we sent the drawings to outside firms who had won a reputation for ingenuity in the design and efficiency in the production of welded structures. We gave these firms the privilege of modifying our designs to give maximum economy when produced in welded steel.

"This practice had been a policy with us for five years preceding our entry into the war. By that time the cost pattern to be expected from such comparisons had become rather clear: Even on intricate water-jacketed work with long, thin cores on which at times our foundry scrappage had run quite high, the best costs on the finish-machined weldments still proved to be nearly twice casting costs."

Williams gave some interesting figures on production of some items, compared to similar structures of welded design.

"As a result of the data we have gathered," concluded Williams, "this study reveals, upon quite accurate bases of comparison, that the cost of finish-machined Diesel engine weldments, in moderate repetitive production, is on the average 330 percent more expensive than the cost of similar Meehanite castings. Sufficient weight and service advantages to offset this cost differential have failed to appear. Therefore, weldments cannot sensibly be considered as a postwar competitor to Meehanite castings in our Diesel engine designs."

3 WAYS TO MARK FAST!
3.
STEEL LETTER AND FIGURE STAMPS
1.
HERCULES HOLDER AND TYPE
ACROMARKER STAMPING MACHINE FOR MARKING INSTRUCTION PLATES, DIALS, SCALES, PARTS etc.
2.
WRITE FOR PRICES AND COMPLETE ILLUSTRATIVE LITERATURE.
THE ACROMARK COMPANY
5-15 MORRELL ST., ELIZABETH, NEW JERSEY

Copper Head Laps are Economical to Use. The only Wearing Part is the Replaceable Copper Sleeve.

COPPER HEAD LAPS PAY FOR THEMSELVES IN TIME SAVED

Costly tool room time is saved when you use Boyar-Schultz Copper Head Laps. They are also fast working . . . a double saving. Copper Head Laps never wear out; sleeve adjustment feature permits maintaining correct lapping size till worn out when it is replaced with a new sleeve. Available from Stock in standard sizes, 1/8" to 2 1/2".

BOYAR-SCHULTZ SMB MACHINE BOLTS

SAVE the Machine • SAVE the Job • SAVE Time

Heat treated alloy steels make them T O U G H for heavy work; machined heads and carefully cut threads make them A C C U R A T E for the most exacting tool room work. Heads are machined square with bodies, presenting a clean, flat surface to the T-Slot. Work is held tightly under heavy machine cuts. Close adjustments are possible.

Avoid worn or poorly made bolts. They can cause costly damage to machine beds, ruining the machine's accuracy.

For best results, use SMB Nuts and Washers. They are specially made for use with SMB Bolts.

BOYAR-SCHULTZ CORPORATION

2112 Walnut Street CHICAGO 12, ILLINOIS

Reg. U.S. HY-PRO Pat. Off.

TAPS

These high production taps produce consistently more accurately threaded pieces to lower the cost of your tapping operations.

Precision ground from the hardened solid of high speed steel, HY-PRO tap tolerances are held to extremely close limits. *Accurate tapping assures tighter, stronger fastenings that defy vibration!* Specify HY-PRO for High Production.

Cut Thread Taps

•

Commercial and Precision Ground Thread Taps

•

Special Ground Thread Taps

Write for Catalog on Company Letterhead

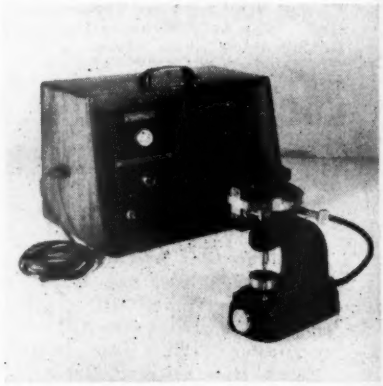
HY-PRO TOOL CO.

New Bedford, Mass., U.S.A.

489 Mt. Pleasant St. BUY BONDS

Carson Electronic Micrometer Reads Accurately To .00005"

The Carson Model L Electronic Micrometer offers a simple yet exceedingly accurate method for measuring dimensions to .00005" without exerting any pressure. Read and used like a hand micrometer it measures grids, plates and other metal parts from the smallest size up to a maximum size of ¾". The Carson Electronic Micrometer takes all guesswork out of measurement and eliminates the human element entirely.



The Model L was designed to meet the needs of certain grid manufacturing operations in the radio tube industry. It readily discloses differences as slight as .00002", yet measures the diameter of the finest grid assembly without flattening, and accurately measures the dimensions of plates, cathode sleeves and other conducting parts.

The instrument, in spite of its extreme accuracy, requires only the care given a hand micrometer and a home radio. For rapid, repeated readings, the micrometer dial is set for oversize dimension and the work is placed on the lower anvil under the micrometer tip. The dial is rotated until the micrometer tip contacts the work which automatically lights a bull's-eye in the base. The electronic circuit gives the reading independent of dial "feel". Further information is available from the Carson Micrometer Corp., Dept. J, P. O. Box 57, Little Falls, N. J. 977-K

You'll Have to Walk the Plank, Boys!

Hitler and his pal, Tojo, are sure to be sunk . . . thanks to mass production and the boys on the firing line . . . MASTER GAUGES are helping in this great program.

THREAD PLUGS
THREAD RINGS
PLAIN PLUGS — PLAIN RINGS
SNAP — PROFILE
CONCENTRICITY AND BUILD-UP GAUGES
JIGS AND FIXTURES

MASTER GAUGE CO.

Phone: University 3-7676
2218 FENKELL AVENUE DETROIT 21, MICHIGAN

TIME SAVER
FOR QUICK CHANGE MARKING

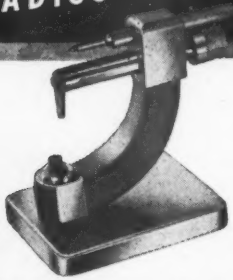
- Fastest and simplest way to number parts.
- Easy! Just turn screw to change numbers.
- Made of best quality tool steel.
- Guaranteed for years of service.
- PROMPT DELIVERIES

STOCK TYPE
1... BA 1864249
2... BA186429
3... BA 1864

SOSSNER
161 Grand St. New York 13, N. Y.

WITH HANDY TYPE BOX

SPEED UP PRODUCTION.. with THE MAKE-ALL RADIUS DRESSER



● Simple to set up . . . easy to operate . . . no difficult calculations . . . no depth gauge-, micrometer- or vernier-settings. Makes concave and convex radii, just one moving part assuring extreme accuracy.

● Send priority rating with your order for quick delivery.

Radius Dresser with one 90° GOLCONE Diamond Tool **$61.00**

Complete MAKE-ALL with 2 Golcones (60° and 90°), one crystal point, one roughing tool, one Semi-Circular Radii Attachment, and 3 Rattail Diamond tools (1⅜", ⅜", ⅛"). **$97.50**

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

Only tool of its kind! Use with Golconda Rattail Diamond Tools to make full semi-circular radii as small as 0.035". Included in complete set-up as described above.

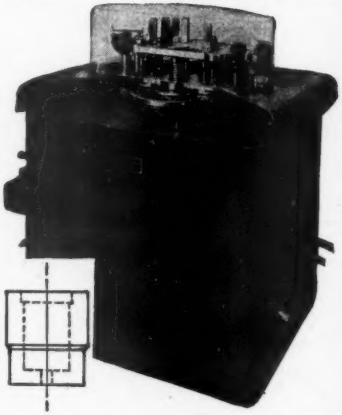
Manufacturers of Precision Diamond Dressing Tools

GOLCONDA DIAMOND PRODUCTS CORPORATION

3854 No. Ashland Ave., Chicago 13, Illinois

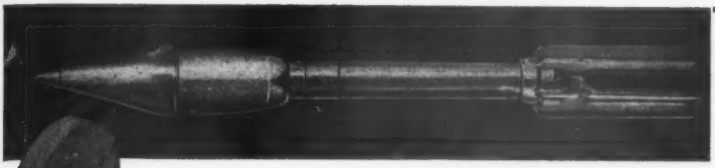
New "Automatic Inspector" Handles 55 Parts Per Minute

A device to automatically check the dimensions of production parts individually at no greater cost than spot-check inspection has been developed by Interlakes Engineering Company, 502 Transportation Building, Detroit 26, Michigan. This machine, the "CHECK-MATIC", performs automatic inspection of parts up to 1½" in diameter and 2" in height, checking "go" and "no-go" limits on such dimensions as outside and inside diameter, depth of counterbore, wall thickness and depth of holes, all to limits of .001". Parts to be inspected are placed in position on the revolving table which



carries them through the sequence inspection operations. If any part does not meet a particular inspection test, it is automatically rejected through a tube which deposits it in a receptacle placed at the outlet and thus the rejected parts are segregated according to the particular inspection which they fail to pass. The standard model has an 18-position table and is designed to check as many as 13 dimensions. The gages, table fixtures and bushings can be quickly changed for the inspection of different work shapes and dimensions.

The "CHECK-MATIC" makes for much speedier inspection than is ordinarily possible, as a 7-dimensional inspection, including concentricity, can be made at the rate of 55 pieces per minute. A plastic hood covers the gages and delicate operating parts. **744-K**



BAZOOKAS and BOMBERS

Minimum wind-resistance is a "must" for bazooka shells and bomber wings . . . Brightboy *rubber cushioned* abrasives get the call for the close tolerance de-burring, finishing and polishing of these vital implements of war. Brightboy's *combination* of abrasive, impregnated throughout a resilient rubber binder, does the job!

Ask our Service Department or field representatives how to save time . . . improve quality . . . in your abrasive finishing.

Ask your dealer for prices and applications data.

BRIGHTBOY INDUSTRIAL DIVISION, WELDON ROBERTS RUBBER CO., Newark 7, N. J.

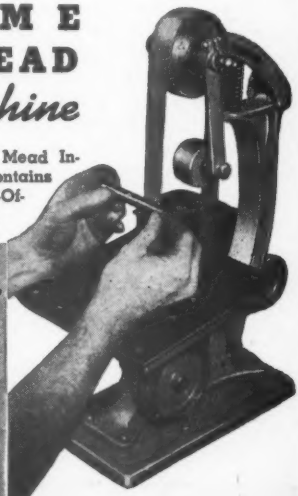
WELDON ROBERTS

Brightboy

---

18 WAYS TO SAVE TIME & MONEY *with the* MEAD *Industrial Burring Machine*

New circular explains, illustrates 18 ways in which the Mead Industrial Burring Machine saves time and money—also contains special Grit Guide. Every industrial plant needs this "Jack-Of-All-Trades" machine. Your burring can be done in "free time"—Install these machines by every machine tool which leaves burrs. Grinds, finishes both outside and inside cut-out openings. Immediate delivery in most cases. Write for the informative Money-Saving circular now.



MEAD Specialties Co.
15 S. Market, Dept. 54-H
CHICAGO 6, ILL.

For METAL - PLASTIC - WOOD

The FORM-MASTER
ANGLE AND RADIUS DRESSER

An all-purpose angle and radius dresser for high-precision at low cost. Accurate easily within .001". Simple to operate. Dresses in horizontal position enabling operator to SEE the form in work. All parts hardened and ground (except cast-iron base which can be drilled and tapped). Suitable for surface and cylindrical grinders. Two 1/3 ct. quality diamonds and instrument case included . . . $150.00.

It readily produces: Any desired angle; Convex radii to 4"; Concave Radii to 7". On 7" wheel.

Specifications: Base 3"x3", height 8½"; Wheel capacity 8"; Angular travel 3".

For information or a demonstration CALL YOUR SUPPLIER.

MANUFACTURED BY
J & S TOOL CO. 477 Main St., East Orange, N. J.
PRECISION DRESSING TOOLS

Foundrymen Hear Wage Incentive Plans Report

Wage incentive plans are accounting for an average increase in productive performance of 25 to 40 percent in regions where they have been adopted, John W. Nickerson, director of the War Production Board's Management Consultant Division, told the American Foundrymen's Assn. in Buffalo recently.

"Ninety-five percent of the plans indicate gains of over five percent, and some run from 100 to 150 percent in specific installations," the WPB official said.

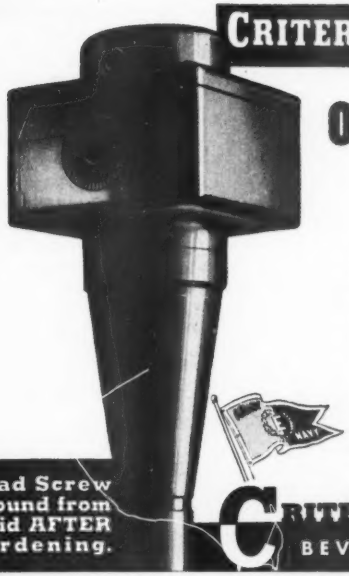
Mr. Nickerson said the special type of incentive plan that is applied to the individual worker and is based upon time studies results in increases in productivity averaging over 60 percent. Other types of plans—those based on past performance and those applying to departments and whole plants—are producing increases averaging somewhat less than 30 percent.

The WPB official stressed that, by boosting the output per worker, wage incentive plans are proving to be a vital aid to war production, by exercising "not only a beneficial effect on total production, but also upon the manpower problem." He pointed out that "when you double productivity, you may double production and remove the necessity for supplying the corresponding man-hours, or else you may get the same production with fifty percent less man-hours."

Mr. Nickerson said that wage incentive plans must be scientifically formulated and applied, because "a carelessly conceived or poorly maintained plan is apt to bog down, cause bad labor relations and end in restricted production." He said that there are many plans all over the country that have been operating for years on an unscientific basis, with lack of proper management attention and accompanied by recurrent labor-management disputes.

"With these conditions cured and with the one-third added production per man-hour which we might expect if industries now on day work saw their way to change to incentives, we should go a long way toward solving our problems of critical areas and industrial deferment," he said.

(TO PAGE 178—PLEASE)



CRITERION *Boring Heads*

Original Accuracy *Maintained*

Noted for maintaining original accuracy over a longer period. Criterion Heads are smooth, compact, rigid. Parts subject to wear are hardened. Lead screw is hardened tool steel, with threads ground from solid after hardening. All heads have large, graduated dial. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½" and 3". ½" and 1" bar capacity. Shanks are interchangeable, enabling operator to use head on different machines. Ideally adapted for slide boring tool holder on small turret lathes. Ask your dealer or order direct. Request free literature.

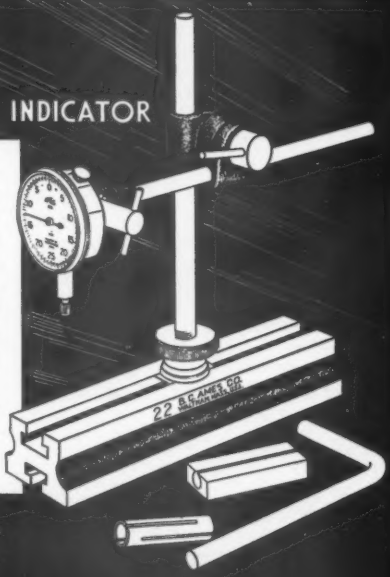
Lead Screw ground from solid AFTER hardening.

CRITERION MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

AMES No. 22. DIAL TEST INDICATOR

An ideal testing outfit for machinists, tool-makers, inspectors, scrapers and assemblers. Handy for determining the flatness of surfaces, roundness and trueness of revolving parts, relative heights and thicknesses, etc. Adjustable to any position, nicely proportioned for easy handling, sturdily built to support the Indicator rigidly, and nicely finished.

Packed in deluxe wooden box. Other models shown in our catalog. Send for a copy.



B. C. AMES CO.
WALTHAM, MASS., U.S.A.

IMMEDIATE DELIVERY
FROM STOCK
On Standard Sizes

HIGH SPEED—PRECISION
CENTER
DRILLS

Attention!

ALL SCREW MACHINE HOUSES

Here is just what you have been looking for. A High Speed, accurate Center Drill that guarantees a perfect center every time.

No longer is it necessary for you to cut down one of your drills for centering purposes. These tools are designed to give long and dependable performance.

SINGLE END—RIGHT AND
LEFT HAND AVAILABLE

★

Satisfaction assured on a complete stock of all types of standard cutting tools and end mills.

Prompt Delivery on Special Tools, Dies, Jigs and Fixtures Made to Your Exacting Requirements

★

Write for prices on standard sizes or submit blueprints for special sizes

Galter Manufacturing Co.
711 W. Lake Street - Chicago, Ill.

(CONTINUED FROM PAGE 176)

Emphasizing the constructive effect that a well operated wage incentive plan can have on industrial relations in a plant, Mr. Nickerson said that "there was never a more favorable time than the present for the serious consideration of wage incentive plans—for a clear definition of a 'fair day's work' and a 'fair day's pay'." He pointed out that in every plant, in every department, some individual or some group is deciding daily what the day's effort will be.

"Is it better that it be decided by tradition, by guess, by prejudice, by chance, by greed, by fear?" "Or is it better that management and labor face the problem honestly and courageously and allow the most scientific, logical and common sense solution to prevail?"

New Stop-off Lacquer For Plating Mask

The availability of a new stop-off lacquer, specifically developed for masking of parts for hard chrome plating, is announced by Michigan Chrome and Chemical Company, 6340 East Jefferson Ave., Detroit, Michigan. It combines many of the most desirable characteristics of their stop-off lacquers HB-401 and HR-302, both widely used for masking purposes, with several additional advantages chief of which is a much greater ease of removal. The new lacquer, known as Miccrome, can be applied easily by brushing, dipping or spraying and provides a smoother and more even coating than the other two lacquers. It offers fast air-drying qualities and requires no force drying. During plating, it adheres perfectly even to surfaces which have been chrome plated. After plating, Miccrome can be easily peeled or dissolved. It can be removed from hard-to-reach spots by hot soaking for a short interval and then blowing the remaining material off by the use of compressed air. Because of this feature, clean-up time is reduced to a minimum. It has excellent dielectric strength which provides accurate control of deposit and a minimum of current lost. As Miccrome trims cleanly, it is always possible to secure a sharp line of demarcation and its clear red color gives definite contrast against the exposed surface. 997-K

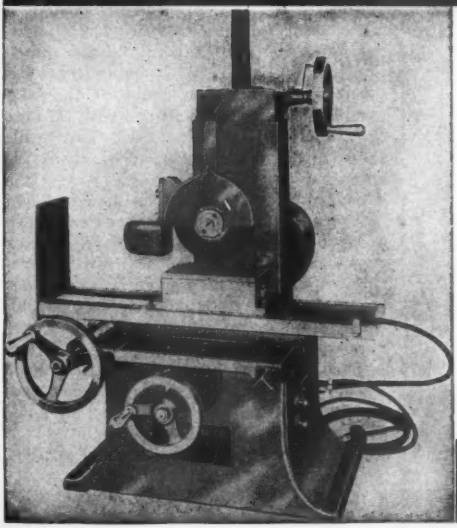
MAKES ALL PRECISION WORK EASIER, FASTER, SAFER

Precision workers all over the country are increasing their production — with greater *eye-comfort*, *accuracy* and *safety* — by wearing a Magni-Focuser Binocular Eye Loop. Its dual-mounted lenses provide *third-dimensional* vision, and magnify an object to needle-point sharpness. Prisms in each lens relieve eye-strain, and the shade shuts out all overhead and side distractions. Normal vision can be resumed at any time by just lifting the head slightly. *Allows free use of both hands.* Available in four different powers of magnification — either in black plastic or white plastic. $8.50 up, in U. S. A. Order from your Wholesale Supply House or write for name of nearest Distributor.

EDROY PRODUCTS CO., 480 LEXINGTON AVE., NEW YORK 17, N. Y.

MAGNI-FOCUSER
Binocular Eye Loop

Sanford precision bench surface grinder



A
HIGH SPEED GRINDER
FOR ALL
SMALL PRECISION WORK

★

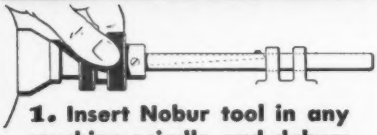
Write for
Specifications
Bulletin No. C
Dealer Inquiries Invited

★

PROMPT DELIVERY

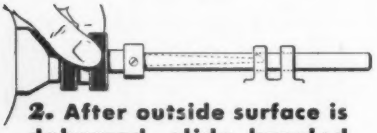
SANFORD MFG. COMPANY
1279-81 SPRINGFIELD AVE., IRVINGTON 11, N. J.

How to deburr holes faster!

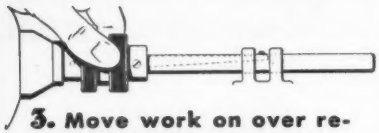


1. Insert Nobur tool in any machine spindle and deburr outside surface of work.

Works like a drill—operator works with complete safety—parts can be burred as fast as they can be handled by operator.



2. After outside surface is deburred, slide knurled sleeve back to retract blade.



3. Move work on over retracted blade and deburr inside surface.

Double-edged cutting blade thus instantly removes burrs around holes in flat or curved surfaces of single or multi-walled parts—smoothly and accurately.

Send for deburring folder. Write

NOTE
All Nobur tools are now furnished with pilot shafts hard chrome plated!

NOBUR MANUFACTURING CO.
912 NO. ORANGE DRIVE
LOS ANGELES 38, CALIFORNIA

"Star Dust" Lapping Abrasives

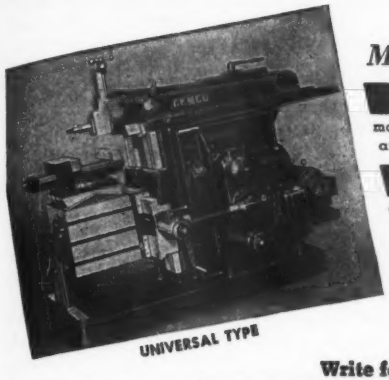
Stimulated by the wartime demand for precision production, "Star Dust" is a new lapping abrasive developed by the Ace Abrasive Laboratories. "Star Dust" is a pure diamond powder made and graded by new methods which are claimed to achieve absolute uniformity of particle size and complete freedom from "out-sizes." It is made from selected industrial diamonds and not from salvaged or reclaimed material. With more lapping to be done by fewer skilled people, gage work has posed a real problem. A faster cutting medium such as "Star Dust" results in a reduction in time per job and due to its uniformity of grade is capable of producing the highest quality of surface. The regular attainment of Profilometer and Brush Surface Analyzer readings of better than one micro inch are reported. In addition to a reduction in gage lapping time, rejections because of over-size, bell-mouth or scratches may be almost completely eliminated.

Plug Gage Lapping Procedure:

For taking off two or three "tenths" use standard cast iron ring or roller laps with freshlly ground surfaces charged with "Star Dust" No. 11. By volume, six parts of light spindle oil should be mixed with one part "Star Dust" powder. In applying the mixture, a small applicator the size of a paper match is used and one or two drops of the mixture are sufficient to thoroughly charge the lap. The lapping procedure calls for using a moderate speed of about 720 rpm and a good firm pressure. As the work approaches size, the speed should be increased and the pressure reduced in order to obtain a super finish. On plug gages up to 1½" OD the entire operation should not take over five minutes. Hard steels, carbide and chrome are all easily and rapidly lapped and superfinished with "Star Dust."

The Ace Abrasive Laboratories, 1 Spruce St., New York, N. Y., manufacturers of "Star Dust", furnish in addition to six special lapping powders a complete range of grit sizes, accurately graded. Consultation and advice on lapping powders are offered without charge. 928-K

Matched for the Job!



UNIVERSAL TYPE

GEMCO

Multi-Purpose SHAPERS

PLAIN TYPE A fast utility machine for a wide variety of the average shop work and for training purposes in industrial schools.

PRODUCTION TYPE Massively constructed with a large table to handle medium heavy work on a peak production basis with high limits of accuracy.

UNIVERSAL TYPE Ideal for tool and die work, experimental laboratories and model shops or where angular work set-ups are required.

Write for illustrated bulletin GC-12D.

Immediate Deliveries on Firm Orders!

GENERAL ENGINEERING & MFG. CO.

ST. LOUIS 4, MISSOURI

Manufacturers of Precision Equipment SINCE 1917

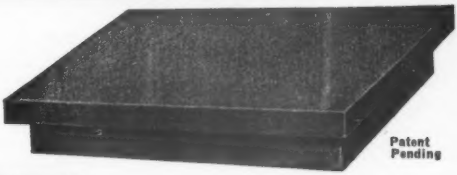
Why . . .

HERMAN

Precision Granite

SURFACE PLATES

Offer Advantages Unsurpassed


Patent Pending

Remember, these revolutionary Surface Plates are cut from solid blocks of natural granite, the ideal material for the exacting requirements of perfect surface plates. And here's why: First, HERMAN SURFACE PLATES are *flat* . . . accurate up to 1/10,000 inch overall. Then, they *stay* flat. No warping! Not affected by ordinary temperature changes! And no other plates can approach these PRECISION GRANITE Surface Plates in hardness . . . outwearing metal plates many times over. Smooth action, too! And non-abrasive, non-magnetic, non-corrosive!

Here's the greatest forward step in Surface Plate development in the past half century. Why not have all its benefits? Write or wire for descriptive circular!

HERE ARE A FEW:

- **Flat, warp-proof**
- **Hard, precision surface**
- **Unapproached accuracy**
- **Amazingly long life**
- **Unexcelled for spotting**

Write for ALL the Facts!

THE HERMAN STONE CO.

1243 Leonhard Street, Dayton 4, Ohio

Get maximum production from lathes, screw machines, punch presses, shapers and other equipment now belt driven from shafts, by modernizing with CULLMAN Motor Drives.

You can increase machine output 25% through greater flexibility, instant control, and belt drive smoothness. You can install a CULLMAN Motor Drive in a few hours. On most machines only four bolts are necessary. CULLMAN Motor Drives are made for motors ranging from ¼ to 15 H. P.

Don't delay. Start taking that extra production now. Prompt deliveries can be made.

CULLMAN
WHEEL COMPANY
1332 Altgeld St., Chicago 14, Ill.

New Engineering Handbook For Arc Welding Tool and Die Steels

A handbook of engineering data, welding procedures and heat treatment procedures for tool and die steels has been published by C. E. Phillips and Company under the title, "Arc Welding in the Maintenance and Construction of Tools and Dies". In the introduction, it is pointed out that the successful use of arc welding on forming, stamping, forging and blanking dies depends on the selection of electrode material which will yield a deposit possessing physical properties comparable to those of the parent metal, and also qualities which respond to the same heat treatment as prescribed for the parent metal. That is, the more that is known about the parent metal, the better the conditions are for a wholly satisfactory application. Ten types of electrodes are described for a certain range or group of steels. The text explains the range of application of each electrode and furnishes heat treatment data, deposit characteristics, physical properties and special details of application procedure. Photomicrographs show grain structures in the as-welded and the heat treated conditions, and tempering curves indicate the hardness ranges obtainable by heat treatment. Illustrations of typical applications suggest that there is a considerable field of usefulness for this process not only in repair and salvage but also in the composite construction of new tools and dies, employing a less expensive steel for the body and depositing only enough of the special steel to provide a working surface or edge. The manual or handbook incorporates several half-tone and line drawing depictions of case histories and techniques. A draw punch with worn edges of two diameters is shown both as prepared for building up and as finished. Likewise, a worn shear blade is shown as a typical application of Phillips Electrode No. HF-55. The proper undercutting for welding several shapes of composite die sections is also plainly detailed. This data book is obtainable upon request from C. E. Phillips and Company, 2750 Poplar Street, Detroit 8, Michigan.

A Wider Range of Tap Sizes

with PROCUNIER TAPPING MACHINES

● These advanced design tapping machines offer you many definite advantages. For instance, the unit here illustrated handles from No. 2 tap up to ⅛" in steel, ⅜" in cast iron, ½" in brass or aluminum—by interchanging two tapping heads. During rapidly changing production conditions, this flexibility is extremely important. Other Procunier advantages include:

1. The improved Procunier tapping head with double-cone cork-face friction clutch and other exclusive features.

2. Four speeds, ranging from 390 to 2050 RPM, efficiently handle jobs for which conventional high speed tapping machines are inadequate.

3. Extra long Spiral Compensating Springs conveniently located, with wide range hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF OPERATOR.

Send for Special Bulletin

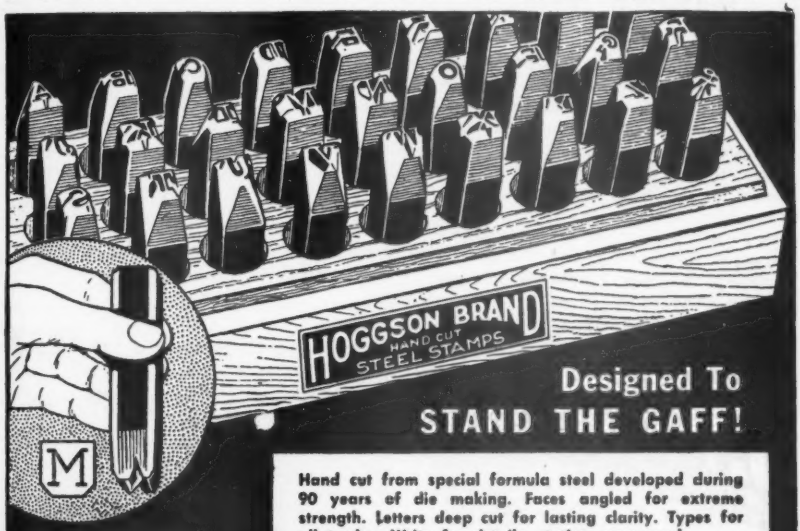
giving full details and prices on the full line of Procunier Universal Tapping Machines, Procunier Precision Tapping Heads and the new Tru-Grip Tap Holder.

PROCUNIER FOR FASTER, MORE ACCURATE TAPPING

The Procunier Safety Chuck Co.
12-14 S. Clinton St., Chicago, 6
Send me bulletins on: ☐ Universal Tapping Machines ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders.

Name .....
Address .....
City .....State .....

MAIL THIS COUPON TODAY



Designed To
STAND THE GAFF!

CHAMFERED CORNERS -- FOR LOCATING BASE OF LETTER

Hand cut from special formula steel developed during 90 years of die making. Faces angled for extreme strength. Letters deep cut for lasting clarity. Types for all trades. Write for details, stating your need.

THE HOGGSON & PETTIS MFG. CO.
NEW HAVEN 7, CONN.

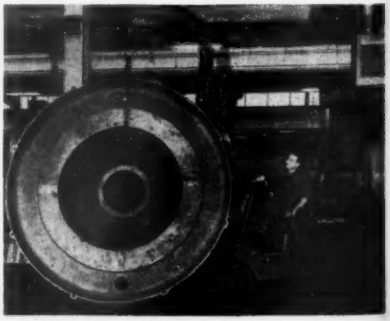
SECOMET
DIAMOND WHEELS

When the war is won—Americans will enjoy higher standards of living than ever before. Motor cars, airplanes, trucks and tractors, home appliances, every machine and tool that's made of metal, will be better, safer and stronger. JKS Diamond Wheels will help to make this possible by processing tougher metals, with greater precision. Far-sighted companies are already designing new products, scanning new outlets and perfecting plans for cutting their costs with improved machine tools. To such executives this is an invitation to write today to—

J. K. SMIT & SONS
157 Chambers St. New York, N.Y. 6400 Fireman Ave. Detroit

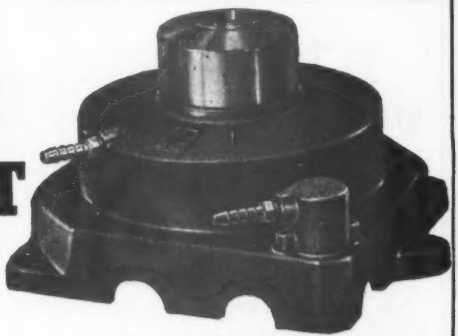
Towmotor Crane For Machinery Lifting

That machinery and equipment manufacturers are ingeniously adapting fork lift trucks to many new uses is brought to light in the plant of the Cleveland Hobbing Machine Company, Cleveland, Ohio. Their Rigidhobbers and Rigidturners are being quickly and easily handled by a standard Towmotor Fork Lift Truck equipped with a crane arm and hook attachment. An attachment developed by Towmotor Corporation for use in their own production, the crane arm and hook facilitates the lifting, handling and transporting of unwieldy objects. The crane arm is adaptable for specialized lifting operations that require reaching over obstacles such as highway truck bodies, flat cars, stock piles and shop machines and for moving materials which have little or no underclearance, such as engines, castings, dies, long bars, structural shapes, machinery components and other objects commonly carried by chains, slings, chain hoists and cranes. The crane arm attachment is readily interchanged with the standard forks of the lift truck. Suspended from the lifting carriage of the lift truck in the same manner as the forks, the crane arm rides up and down with the lifting carriage. Lifting is accomplished by the regular mechanism of the lift truck, with the standard control at the operator's position. Complete crane arm specifications, dimensions and capacities are available from Towmotor Corp., Dept. J, 1226 E. 152nd St., Cleveland 10, Ohio. **495-K**



Announcing

MEAD AIR COLLET FIXTURES



These new high production precision fixtures open up new vistas in the field of second operation work. Their accuracy will meet the most rigid requirements; their fast action leaves nothing to be desired; their compactness does not waste a fractional inch. They will hold a 1" bar so firmly that a strong man cannot turn it with a 12" pipe wrench, yet in conjunction with a suitable pressure reducer they will gently handle the most delicate of precision parts as low as $\frac{1}{16}$" in diameter. Automatic ejection of finished work.

MEAD SPECIALTIES COMPANY
15 SO. MARKET ST., DEPT. 54-HA, CHICAGO 6, U. S. A.

Write for new Mead Air Power Catalog

VALUABLE BOOKLET AVAILABLE

Forgings For All Industries
Rough Turned or Finished Complete

Composite Die Sections • Extrusion Tools • Crankshaft Forgings • Gear Forgings • Die Casting Dies

Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes.
Tool Steel of all Makes

S.A.E. and NE Specifications

STAINLESS & COPPER FORGINGS

May We Serve You?

AJAX STEEL AND FORGE Co.
205 ADAIR STREET **DETROIT, MICHIGAN**

BURKE
MILLING MACHINES

No. 4 Motor Driven MILLING MACHINE
Mounted on Cabinet Column

Burke motor driven milling machines Nos. 1, 2, 3, and 4 are specially suited for handling small, difficult work on a production basis.

Write for complete information.

Burke Machine Tool Co.
301 E. 16th St. -:- Conneaut, Ohio

New DoAll Butt Welder

A new DoAll Butt Welder, latest addition to the line of Continental Machines, Inc., is equally adaptable for making extensions to small tools, repair or salvage of broken tools, joining of steel rods, tape or wire up to ⅝" diameter as well as the first use of joining square ends of standard band saws.

The new DoAll Welder is completely automatic and is easily operated by inexperienced persons with a minimum of instruction. Operation is reduced to four simple steps which assure precision welding: (1) the parts to be welded are inserted into the welder jaws and

clamped. Auxiliary welding jaws, which permit clamping of a variety of shaped parts, are furnished with each unit; (2) the welding switch is pressed (as illustrated); (3) the annealing switch is pressed; (4) and the weld flash is dressed off. These operations are all accomplished on the butt welding unit. The DoAll will weld continuously and produce perfect welds indefinitely without overheating. No adjustments are neces-

(TO PAGE 188—PLEASE)

for Rapid, Convenient and Accurate Measurements... use the SWEDISH INTERNAL INDICATOR GAGE

Variations of as little as 0.00005" in size, out of round, and taper of bores can be quickly and accurately determined.

A light, easily handled instrument for use on internal grinding, diamond boring or honing machines; or wherever a reliable method of accurately determining bore diameters is required. Its use by machine operators for final inspection INCREASES PRODUCTION, REDUCES SCRAP and assures A MORE UNIFORM PRODUCT. Scale range: Plus or minus 0.001" graduated to 0.0001" and minus 0.020" graduated to 0.001". The plus or minus 0.001" range graduated to 0.0001" is used for checking the finished part. It can be set to any required size direct from Johansson Gage blocks or master ring.

SWEDISH GAGE CO., OF AMERICA
8900 ALPINE AVE. DETROIT 4, MICH.

Rawhide

C/R

The [illegible] soft" hammers and mallets are rawhide — tough, resilient, long-lasting C/R mechanical rawhide. They strike effective blows without battering or marring . . . without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.

Write for Catalog Sheets.

CHICAGO *Rawhide* MFG. CO.
1200 ELSTON AVE. ★ CHICAGO, ILLINOIS

(CONTINUED FROM PAGE 186)

sary for different sizes of saws or tool welds.

For butt welding square ends of band saws—the capacity is band saws of $\frac{1}{16}$" to 1¼" wide—the first three steps are

UNIVERSAL DRILL BUSHINGS

Universal Drill Bushings save valuable tool drills on a wide variety of applications. Because they are straight and round and have superfinished bores, Universal Drill Bushings insure accuracy and possess unexcelled wearing qualities. It will pay you to use these tough, precision-made bushings. Write today for catalog.

UNIVERSAL ENGINEERING
FRANKENMUTH, MICHIGAN

made with the ends of the saw butted together in the jaws of the welder. Then the saw is removed from the jaws and the flash from the weld is ground off. A thickness gage for all standard band saws is provided so that proper dressing of the weld is assured.

The Eastern Aircraft Company of Linden, N. J., was one of the first firms to use butt welding equipment for drill salvage and small tool making. Butt welding, particularly of extension drills, has proven so much faster than previous methods that it is being adopted by industries all over the country. The same four steps used for butt welding saw ends are utilized in producing extension drills.

The operator clamps the drill and extension shank in the butt welder jaws. The blunt part of the drill shank is ground to a flat surface on the welder grinding wheel. The operator places the drill and extension shank in the V slots of the electrodes and presses the welding switch. This is the operation illustrated. Closing the switch automatically brings the electrodes together, the current flows through fusing the butted ends. The current is automatically cut off at the critical moment of temperature. The annealing switch is pressed until the new, solid joint becomes dull red. This completes the weld. The extended drill is removed from the jaws and the flash is ground off on the built-in grinding wheel. A recent application of this technique was the welding of the

(TO PAGE 190—PLEASE)

TAKE ADVANTAGE

OF THE *EXTRA* SPEED THE KNURLING PERMITS

Knurling of Socket Screws originated with "Unbrako" years ago.

KNURLED
SOCKET HEAD
CAP SCREWS

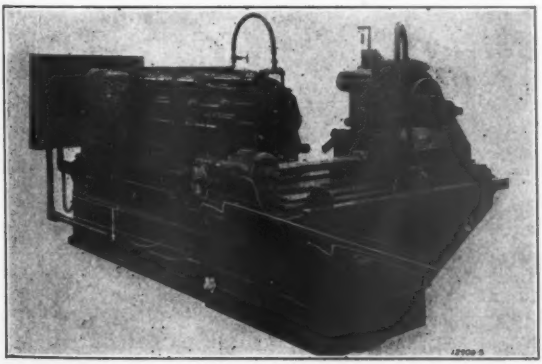
Knurling the heads of "Unbrako" Cap Screws affords a firm, non-skid grip for the fingers, handiest of wrenches —no slipping and lost motion, thereby speeding assembly. In close quarters this knurling also facilitates minor adjustments with pliers; and permits locking in counterbored holes. Of exceptional strength and accuracy, knurled "Unbrako" Socket Cap Screws are available in a full range of lengths and in diameters from No. 4 to 1½". Send for the "Unbrako" catalog.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 600. Branches: Boston, Detroit, Indianapolis, Chicago, St. Louis, San Francisco

BAKER

Model 3½ x 24 Multiple Spindle Fully Automatic Cycled Machine



The Model 3½ x 24 Horizontal Hydraulic Feed Multiple Spindle Fully Automatic Cycled Machine was developed to step up production rates at a minimum of operator fatigue and effort. The Unit Multiple Head carries 15 spindles; 8 at the front station for drilling from the solid and rough boring center large bore; 7 spindles at the rear station for finish boring and finish counterboring.

Descriptive Circular on Request

BAKER BROS.
TOLEDO 10, OHIO

OLIVER
DIE MAKING MACHINES

THE basic needs of faster, smoother sawing and filing are met with the Oliver Die Making Machines. Operating efficiency is increased 50 to 60 per cent over hand methods in the making of precision dies, gages, cams, templates and similar products requiring rapid and accurate filing, sawing and lapping operations.

Send for literature describing the line of Oliver Die Making Machines!

•

OLIVER INSTRUMENT COMPANY
1436 Maumee St., E. • Adrian, Mich.

We also build Drill Grinders, Tool and Cutter Grinders, Face Mill Grinders, Template Tool Bit Grinders.

(CONTINUED FROM PAGE 188)

tubular rip cord rings used on all parachutes.

An electric etching attachment is available for use with the Butt Welder. The pencil is clamped to one of the welder jaws and is ready for instant use in marking tools, templates and parts.

The DoAll Butt Welder is available in two models, one as illustrated—on a pedestal mount—the other a portable model furnished with a welded steel carrying case.

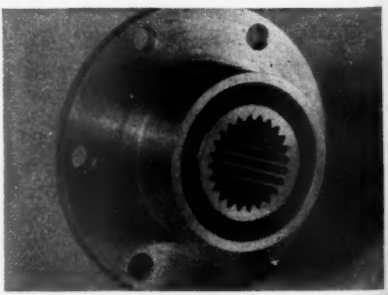
For your copy of the folder, "The DoAll Butt Welder", giving complete step-by-step instructions and complete specifications, address Continental Machines, Inc., 1303 Washington Ave., S., Minneapolis 4, Minn. 130-K

Synthetic Bushing Simplifies Splined Shaft Coupling Design

A new splined shaft coupling designed and now being produced for a manufacturer of electric power generators by Bushings, Inc., Berkley, Mich., consists of only three parts—the splined inner sleeve, the flange and the separating bushing of a synthetic material, Neoprene. The synthetic acts as the insulating medium and permits operation in the presence of a lubricant. Neoprene was the first commercially successful synthetic rubber and possesses good resistance to chemicals and oils and excellent resistance to heat.

The new coupling is designed to stop the transmission of noise, absorb shock and impact, and to compensate for misalignment between drive and driven

(TO PAGE 192—PLEASE)



simplified grinding

with **PARKER-MAJESTIC**

Internal and External Grinders

For precision grinding . . . internal or external . . . Majestic simplicity of design and flexibility of changeover guarantee maximum grinding output at low cost.

Send for descriptive circular . . NOW!

Representatives in all principal cities

MAJESTIC TOOL & MFG. CO.

2950 EAST WOODBRIDGE • DETROIT 7, MICHIGAN

Delivering to War Industry

Improved Steel

for Better, More Durable Weapons of War

THE LAKESIDE STEEL IMPROVEMENT CO

5418 Lakeside Avenue CLEVELAND, OHIO Phone HEnderson 9100

(CONTINUED FROM PAGE 190)

shafting on a 75 hp engine driven generator. This coupling is rated for operation at 600 rpm with a maximum torque of 788 in-lbs.

The new design eliminates an entire separate flexible coupling and reduces the space required for such a coupling. Fewer parts do more work and increase the general efficiency of the coupling. The same general design, with either keyway or splines, is capable of handling virtually any load by use of the proper thickness and hardness of the rubber or synthetic.

For complete data on this and other applications of synthetic bushings, address Bushings, Inc., 3442 W. Eleven Mile Rd., Berkley, Mich. 222-K

Cast Resin For Radial Drill Parts

The use of a cast resin for structural parts of radial drills is a plastics tooling development of interest at Consolidated Vultee Aircraft Corporation, San Diego, Cal. The material, Toolite, produced by Adhere, Inc., of Los Angeles, is now in use in a wide variety of production tools, including hydropress dies, stretch press forms, sinking dies, router blocks and checking fixtures.

Instead of being cast in a split mold, heretofore considered standard practice, parts for the radial drill are being cast in one piece with a core of air filled Toolite which remains inside the mold. Parts cast are 18 x 24" and 12 x 22" and the 14" stand.

Light in weight—Toolite is lighter than magnesium—tough and inexpensive and with a compressive strength up to 20,000 psi this thermosetting resin has many possibilities, according to aircraft manufacturers. It is inert to ordinary cutting compounds, is within allowable oil and water absorption limits and withstands a temperature of 400° F.

Toolite is a liquid casting compound requiring only the addition of catalyst or setting agent. After the catalyst has been thoroughly mixed into the Toolite, the mixture is poured into the mold. No pre-heating is required; the mixing and pouring is done at room temperature. The Toolite is then oven-baked to form a durable, rigid casting.

"Toolite", a new booklet, gives the casting procedure step-by-step, the

(TO PAGE 194—PLEASE)

as far as the eye can see...

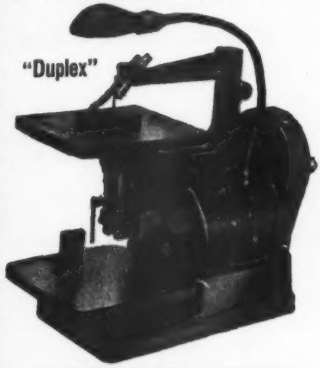
through the light haze of this gigantic welding department extend triple rows of C-F Positioners. From this almost endless production line (the photograph is taken from the half-way point) each day come heretofore unheard of numbers of fabrication with all seams, joints and unions strongly and smoothly welded "downhand".

There are no handling problems or delays, for on C-F Positioners each welder positions his weldment for succeeding welds with a push-button control—can rotate it at any desired speed (360°) or tilt it to any angle up to 135° beyond horizontal.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO. 1316 S. KILBOURN AVE., CHICAGO 23, ILL.

TWO MACHINES IN ONE
FOR DIE FILING
Use Top Table as Shown
FOR PUNCH AND BLIND HOLE FILING
Tilt top table back. Use lower table

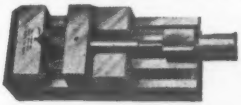


ADJUSTABLE STROKE 0" to 1⅛"
ADJUSTABLE SAFETY FRICTION DRIVE

ULTRA PRECISION

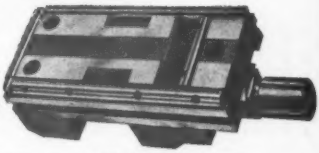
SINE VISES *Master Gage Builders!*

For SURFACE GRINDING, LAYOUT, INSPECTION OF GAGES, TOOLS, AND FINE INSTRUMENTS



No. 2 (Sine of 5") TILTS ONE WAY as Sine Bar. Opens Three Inches Size, 6"x2½"x2¼"

No. 3 TILTS THREE WAYS Sine of 6" & 3" Size 7½"x3½"x2¾" Opens 3½"



HARDENED, GROUND, LAPPED

Features Include:

1. **Precision Sine Rolls**
2. **Non-Projecting, fully covered, Telescoping Screw**
3. **Removable Grip Screw Knob**
4. **Prismatic Slide Jaw**
5. **Accurate Integral V-Block**
6. **Tolerance .0002"**

WRITE FOR CIRCULARS

IDEAL TOOL and DIE CO., INC. - 735 CONGRESS STREET SCHENECTADY, N. Y.

Portrait of Precision

Thousands of Haines Special Gages are accelerating output in ordnance and aircraft plants throughout the country. • Representative Haines gages as well as the men and machines which produce them, are shown in a bulletin just off press. A copy will be sent on request. Haines Gauge Company, 2301 W. Allegheny Ave., Philadelphia 32, Penna.

Haines ARMY E NAVY **PRECISION GAGES**

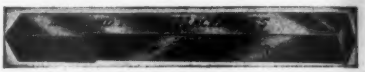
PLUG • RING • SNAP • FLUSH PIN • PROFILE • ETC.

(CONTINUED FROM PAGE 192)

physical properties and characteristics and a suggested list of equipment required. For your copy, address Adhere, Inc., 1220 Maple Ave., Los Angeles 15, Calif. 980-K

Metal Bonded Diamond Hand Hone

The Oscap Diamond Hone, designed with diamonds set in a hard metal bond and providing a new method for keeping cutting edges keen, is now available from Diamond Tool Replacements, a division



of Oscap Manufacturing Co., Inc., 207 W. Saratoga St., Baltimore 1, Md. Shop tested in a number of plants for nearly a year, the new type of tool has proven very successful. A few strokes quickly sharpens high speed steel as well as the hardest grades of cemented carbide tipped tools.

It is claimed that this hone holds its flat surface longer and will not score, groove or chip. According to the manufacturer, the new Hone can be used by the experienced or inexperienced worker with equal success in sharpening edges.

The Oscap Diamond Hone has been developed by a company with nearly 40 years of diamond experience, including the manufacturing of diamond-impregnated saw blades now in use in a number of important industrial plants. The Hone is made in three grit sizes—coarse, 100 grit; medium, 220 grit; fine, 320 grit; and is approximately four inches long. Immediate delivery is promised for qualifying priorities. 981-K

Rockwood New Chicago Institute Secretary

George W. Rockwood is the new secretary of the Chicago Tool & Die Institute representing Special Tool and Die Manufacturers in Chicago. The former secretary, Mr. S. H. Sinclair, has accepted a position as sales manager with the Federal Tool Corporation, 412 N. Leavitt St., Chicago, Ill. The offices of the Chicago Tool & Die Institute are located at 176 W. Adams St., Chicago 3, Ill.

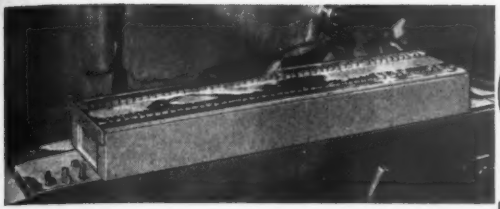
DoALL

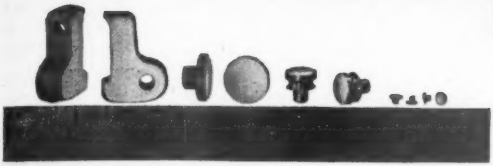
INDUSTRY'S NEW SET OF TOOLS

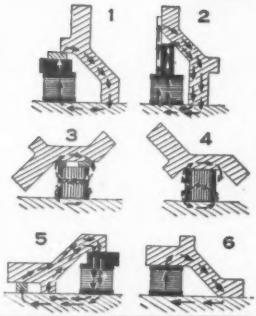
Write for Literature on above Products to THE DoALL COMPANY, Des Plaines, Ill.

Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Portland, Rochester, Rockford, St. Louis, Salt Lake City, San Francisco, Seattle, Spokane, Toledo, Tulsa, West Hartford.

Contour Sawing Machines
Band Files
Surface Grinders
Grinding Wheels and Chucks
Cutting Oils and Soluble Oils
Dust Collectors and Coolant Systems
Speedmaster Variable Speed Pulleys
Band Saws
Band Files
Inspection Laboratory GAGE BLOCKS with Instruments
POWDER METALLURGY Metal Powders and Equipment







These illustrations show a few of the many grinding operations made possible by using "POWER GRIP" Magnetic Chucks.

Line drawings at right indicate path taken by Magnetic Flux through Chuck, Parallel, work to be held, and extra Iron Blocks to handle difficult setups.

The units operate on 110 volts A. C. transformed and rectified to 6 volts D. C. Send for complete catalog.

ROCKFORD MAGNETIC PRODUCTS CO.
1019 Sixth Avenue, Rockford, Illinois

ORDER
ORDER
WHEN ORDERING
Specify
GIBSON
ALL TYPES
ALL SIZES
ALL METALS
SPRINGS
Why take chances with untried sources or products—especially now—on vital parts such as springs? Specify GIBSON springs and you get properly designed, skillfully made, thoroughly tested springs, with 65 years' experience back of them. Large production facilities and separate Small Order Department keep prices moderate, deliveries quite prompt, even today. May we quote on your requirements?
THE WILLIAM D. GIBSON CO.
1800 Clybourn Avenue
Chicago 14, Illinois
(DIVISION OF ASSOCIATED SPRING CORPORATION)
GIBSON-SPRINGS

Makers of
FORM MILLING CUTTERS
and
SPECIAL MILLING CUTTERS
to Order

WILLIAM REID CO.
2271 CLYBOURN AVE. • CHICAGO 14, ILL.
TELEPHONE: DIVERSEY 3766

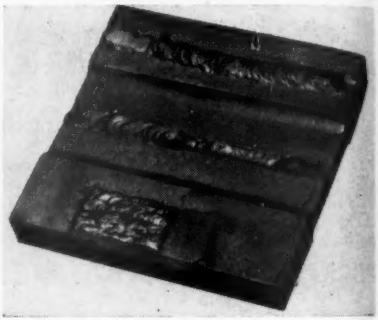
Miccro
Supreme
IMPROVED
LAY-OUT-DYE

FOR TOOL, DIE, PATTERN OR TEMPLATE LAYOUT ON METAL

LOW IN PRICE
MICHIGAN CHROME & CHEMICAL COMPANY
4350 E. Jefferson Ave. • Detroit 7, Mich.

Metallic Arc Welding of Aluminum

The Research Department of the Eutectic Welding Alloys Co., New York, announces EutecTrode 2100, a new electrode with a new coating for the welding of aluminum sheet and castings. While gas welding of aluminum has been possible for some time, the use of the metallic arc process for welding aluminum sheet tubing and castings,



particularly the latter, was not as successful as the metallic arc welding of steel.

With the new rod it is possible to add metal without completely preheating the casting and without the danger of overheating the metal adjacent to the weld. The use of the EutecTrode 2100 opens a new field for arc welding—the salvage and reclamation of aluminum castings. The operation is extremely rapid; therefore economical and makes the salvage of defective castings a very simple and inexpensive procedure.

EutecTrode 2100 is a high aluminum and low silicon composition which alloys itself to pratically every type of aluminum. It has been used very successfully, according to the manufacturer, in the addition of metal on faulty or improperly machined castings, overlaying of surfaces which have been improperly cast, filling of low spots, changing of aluminum patterns already machined, filling of incorrectly placed drilled holes, filling and overlaying of porous castings and welding of casting to aluminum sheet.

(TO PAGE 198—PLEASE)

JUST OUT! ABSOLUTELY NEW!

NEW 2½" Thick TRUPLANE Surface Plate allows you to

1. Clamp Fixtures To It and
2. Deflects Not Over .0002"

with a live load of 194 lbs.

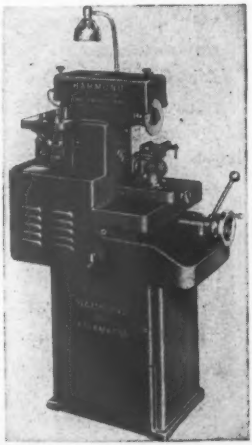
You can clamp fixtures as required to this new Truplane Structural Glass Surface Plate. It is extra thick so as to deflect not more than .0002". This was tested and proved with a live load of 194 lbs. on a 20" x 30" plate. On smaller sizes the deflection is negligible.
The TRUPLANE plate outlasts ordinary cast iron or steel because it has a Rockwell Hardness of "C"-70. Costs no more than ordinary cast iron plate. Available in standard sizes for immediate delivery without priority. Not affected by temperature changes. Guaranteed overall flatness of .0002". Non-corrosive, non-magnetic. Does not rust or sweat. Cleaned with soap and water. Does not warp or twist with age. Although surface may be scratched, scratches leave no burr, do not affect accuracy.

14" x 18" 54.50
16" x 20" 64.75
20" x 24" 99.20
Plywood cases Free
F. O. B. Cleveland, Ohio

DIE SUPPLY CO.
4751 Hough Ave.
Cleveland 3, Ohio

Hammond CHIP BREAKER and DIAMOND FINISHING GRINDER

- ★ HANDLES ALL SIZE CARBIDE TOOLS . . .
- ★ ACCOMMODATES ALL ANGLES . . .
- ★ FULLY PROTECTED AGAINST GRIT AND SLUDGE . . .
- ★ VIBRATIONLESS OPERATION THRU RUGGED HEAVY DUTY CONSTRUCTION . . .
- ★ BALL BEARING—SMOOTH—ACCURATE . . .
- ★ WEAR PROTECTED—MAXIMUM SPEED . . .

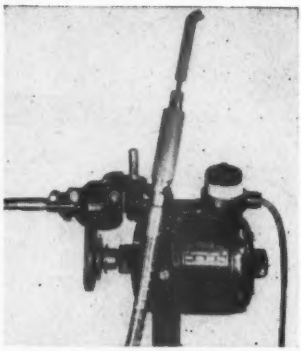


This grinder . . . with its rugged, heavy machine tool type construction throughout . . . makes it unnecessary now to just "get by" with light inadequate equipment.

Hammond Machinery Builders INC
KALAMAZOO MICHIGAN

Write for complete information and prices

1631 DOUGLAS AVE. • KALAMAZOO, MICHIGAN
Eastern Branch: 71 W. 23rd Street - New York 10, N. Y.



Angle tool attachments for use with flexible shafts and rotary files on die and mold making are held in either a drawn-in collet or drill chuck. Burrs or rotary files are held in the threaded end of the attachment. Angle tools are available in 45° and 90° models in two sizes.

Complete details in Invincible Catalog

INVINCIBLE TOOL COMPANY

116 Empire Bldg., Pittsburgh 22, Pa.

WANTED . . .

Manufacturer of Critical Metal Cutting Tools operating nation-wide, with first-class products accepted and recommended by Army, Navy, Air Corps and Ordnance, desires representation in following areas: Metropolitan New York; New Jersey proper; Detroit area; northern State of New York; Los Angeles area; San Francisco area; Pennsylvania; Alabama; Georgia; New Orleans area; Tennessee; Missouri; Minnesota and Texas.

Interested parties with proven following apply for details. Box US-5.

TOOL & DIE JOURNAL
2460 Fairmount Blvd.
Cleveland 6, Ohio

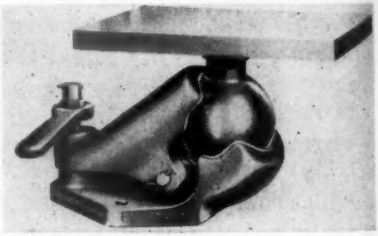
(CONTINUED FROM PAGE 196)

Another application is in the joining of aluminum sheet. The extremely high rate of fusion of this new type of rod produces a smooth, strong, homogeneous fillet with great speed, avoiding distortion and stresses. Joints are leakproof, machinable and show tensile strength comparable to the parent metal. The illustration shows three types of weld made with EutecTrode 2100 on an aluminum casting. The top weld is a single bead deposit; the center weld shows 2100 used in a "V" groove; the bottom weld represents a pad built up on a casting. 81-K

Hold Work at Any Angle

The Metro Positioner, a tool for holding or clamping work during toolroom or production operations—e.g., milling, drilling, shaping, boring, checking and similar jobs—is the most recently developed tool offered by Metro-Vise Co., Stephenson Bldg., Detroit 2, Mich.

A vise or fixture may be bolted or fastened to the "place plate" of the tool. The ball and socket design of the Metro Position permits tilting the clamped work at any desired angle. A conveniently located handle operated thumb



screw locks or releases the place plate quickly and positively. There are no graduations; the babbitt jaws give smooth operation and provide a rigid, non-slip hold.

The Metro Positioner is available in two standard sizes: the 3" size measures 5¾" high and has a 4" x 6" place plate; the 4" size measures 7¼" high and has a 8" x 11" place plate.

Address Metro-Vise Co., Stephenson Bldg., Detroit 2, Mich. 991-K

ILLINOIS DIE FILING MACHINE

Reduce costs and improve quality with this TRIPLE-PURPOSE Machine

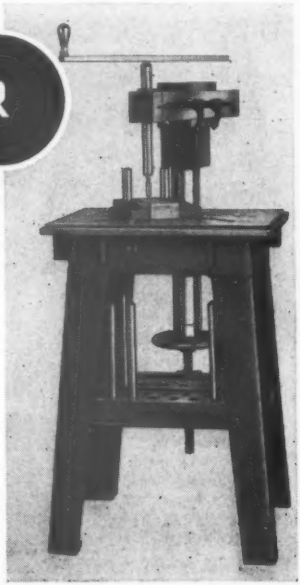
A versatile bench type machine for all three major production steps in the die-making process—sawing, filing and stoning. Quality built throughout to stand up longer and produce more accurate work. Forced-feed lubrication plus hardened and ground shafts running in bronze bushings combine to minimize wear and prolong life. Maintained accuracy is secured through holding chuck and clamping device which provide positive file alignment, and balanced moving parts which operate without vibration. *Write for descriptive literature.*

ILLINOIS TOOL WORKS

Manufacturers of Metal Cutting Tools and Shakeproof Products

2501 N. Keeler Avenue — Chicago, Illinois

Producto HAND TAPPER



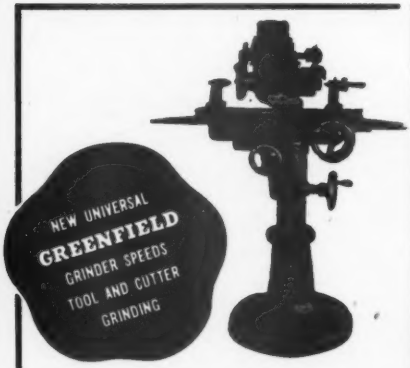
A machine which every tool and die room needs and every machine shop can use is the Universal Hand Tapping Machine. This new development, an improvement over previous models, has a much larger capacity and usage. The idea of guiding taps in a hole by means of a guide bushing is now the accepted way to do the job quickly and accurately. New improvement includes sliding arm, adjustable vertical position . . . to position taps in any place on the table of machine . . . handles taps in sizes from No. 5 to 1" diameter.

Ask for bulletin giving full information.

THE PRODUCTO MACHINE COMPANY

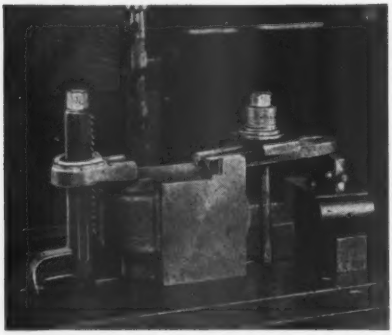
BRIDGEPORT 1, CONNECTICUT

Also manufacturers of Producto Die Sets and Die Makers' Accessories.



The rugged GREENFIELD No. 4 Tool & Cutter Grinder is serving industry as an invaluable production and tool-room machine. The spindle design of the new and improved GREENFIELD Wheel Head incorporates generous bearing areas—scraped to fit and thoroughly run in. Quickly and easily set up attachments provide tool-room versatility for grinding formed cutters, taper and rose reamers, flat surfaces and compound angles. Send for detailed and illustrated job application bulletin.

PRODUCTION MACHINE CO.
GREENFIELD, MASS.



↑NEW WAY ↑OLD WAY

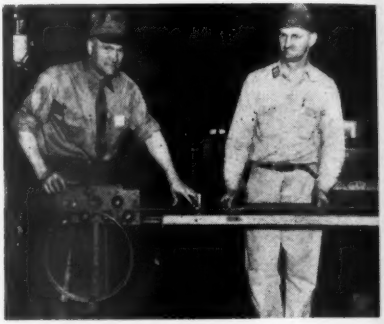
SPEAKS FOR ITSELF

Howell "high speed" adjustable work clamps save time, trouble and worry. Why risk tool breakage, job spoilage or injury by using make-shift methods? Send for descriptive literature describing these unique clamps.

HOWELL CLAMP COMPANY
1373 East 95th St., Cleveland 6, Ohio

Shop Built Tubing Straightener

A tubing straightener, simple yet very effective, devised by two shopmen at the Grove City, Pa., plant of The Cooper-Bessemer Corporation, has eliminated former hand straightening operations and saved many valuable man hours that were utilized for more productive work. The straightener is made of a few



odds and ends of metal and a series of five rollers. The coil is placed over a bracket on the side of the device, the loose end is threaded through the rollers and the tubing is straightened by pulling it out along a horizontal tray where it is measured and cut as required.

The tubing of ¼" and $\frac{5}{16}$" diameter, previously had been unwound as needed, straightened with a paddle, then bent and formed to fit a specific connection. Nearly a mile of such tubing is used monthly in the assembly of Cooper-Bessemer diesel engines for various branches of the armed forces.

The men in the illustration, Howard Knisely, left, and Frank Babcock, right, designed and constructed the device.

New Patents of Tooling Interest

(for obtaining, see page 120)

DIE HOLDER, No. 2,336,771.
GRINDING MACHINE, No. 2,336,796.
CHECKING DEVICE, No. 2,336,845.
CUTTER STOP FOR MACHINE TOOLS, No. 2,336,849.
MANUAL TAPPING DEVICE, No. 2,336,947.
GRINDING MACHINE, No. 2,336,955.
PRESS, No. 2,336,982.
CUTTING TOOL, No. 2,336,986.
ADJUSTABLE PROCESSING PUNCH, No. 2,338,095.
MILLING MACHINE, No. 2,338,116.

USE

Fluid Motion for modern form-dressing

ONE SETTING
HANDLE
CONTINUOUS MOTION

The J & S Model "E" Radii and Angle Dresser in the new "Fluid-motion" series is one of the finest precision dressing instruments procurable—regardless of cost.

FEATURES

Fluid-motion dressing
.0001" accuracy
Automatic centering
14" wheel capacity
Large range yet compact
Chatterless and dustproof

J. & S. TOOL CO.
477 MAIN ST. E. ORANGE 5, N. J.

"STAR DUST"
LABORATORY GRADED
PURE DIAMOND POWDERS

Precision LAPPING POWDERS
for PRECISION work GAUGES, TOOLS, DIES, etc. with tremendous TIME SAVING

The following factors have made STAR DUST indispensable in lapping and superfinishing operations on HARD STEELS and TUNGSTEN CARBIDE.

- Absolute control of particle sizes
- Complete absence of out-size particles
- STAR DUST sizes as fine as .0001"
- Complete range of grit sizes

Consult us about your lapping and super-finishing problems.

STAR DUST speeds up production enormously and produces finishes and superfinishes down to less than .0000004 of an inch.

ACE ABRASIVE LABORATORIES
ONE SPRUCE STREET
NEW YORK 7, N. Y.

CADILLAC

GLASS
SURFACE
PLATE

The
TRANSPARENT PLATE
with the
HIGHLY POLISHED SURFACE

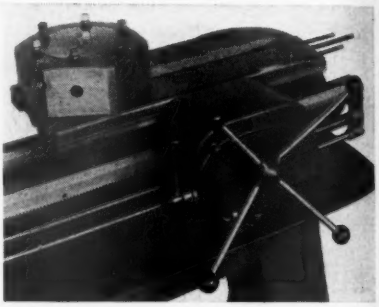
Cadillac Glass Surface Plates have given uniform satisfaction in hundreds of plants. Produced in sizes from 8"x 8" to 18"x 24" and in accuracies from .0002 to .0005. Prices range from $11.00 to $90.00. Comes packed in individual box, top of which forms a protecting cover. Drop us a line for further data.

CADILLAC
GLASS COMPANY

900 West Cermak Road
CHICAGO 8 ILLINOIS

Interchangeable Hexagon Bed Turret

The Regal Lathe in the 13" and 15" sizes is now available with an interchangeable hexagon ram type bed turret according to an announcement just made by the manufacturer, the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. The turret, available with power feed or hand feed only, is exceptionally large—9" across faces—assuring long life in alignment and accuracy. The six station head is supported on double preloaded



adjustable precision roller bearings. The turret is automatically indexed to the next station by the pilot wheel when the ram is returned against the indexing trip, or it can be turned by hand to any face in either direction.

The forward feeding motion of the ram is automatically disengaged when the stop screws move against the trip. The holes in the turret can be bored to customer's specifications up to 1". Drive for the turret apron is taken from the feed rod, making the full range of feeds (.0025 to .144) available and selected quickly by the quick change feed box. The apron is similar in design to, and has all the advantages of, the regular carriage apron, including positive feed, automatic forced lubrication and it has a safety device on the feed rod that releases the feed when the tool is not under pressure or an obstruction gets in the path of the forward movement of the ram.

The saddle casting takes the same bearing on the ways as the tailstock. The

(TO PAGE 204—PLEASE)

REID *Automatic Feed*
Surface Grinder No. 2A
A Proven Product for Over a Quarter Century with Thousands in Use Daily
Send for Descriptive Literature — EXCELLENT DELIVERIES
Our dealers will help you fill out necessary priority forms. Write us today for your nearest dealer's name and address

Exclusive Selling Agents
H. LEACH MACHINERY CO.
387 CHARLES ST. PROVIDENCE, R. I.
Agents in all Principal Cities Throughout the World

SAFETY "WEDGE GRIP" STEEL HAND STAMPS

Pat. No. 2,089,794

Ideal for mass production markings of defense products . . . trade marks and symbols. Any size or number of characters available.

Write for Literature

CUNNINGHAM CO.
SAFETY STEEL STAMPS
104 Carson St. Pittsburgh 19, Pa.

For MARKING *Tough* METALS
HEAVY DUTY ALLOY STEEL TYPE

HAND HOLDER—This popular Heavy Duty Holder is easy to grip. Available from stock. Allen head set screw holds type rigidly and affords quicker changing of characters.

PURPOSE—For stamping parts requiring stronger type than Standard. Heavy Duty Type of alloy steel, when used with above Hand Holder, not only gives longer service but also top quality marking.

TYPE CONSTRUCTION—Heavy Duty Type has a heavier bevel, larger body, is engraved deeper, and all the potential fracture points have been eliminated.

Write for Literature

MARKING EQUIPMENT
ADOLPH GOTTSCHO, INC.
190C DUANE ST. NEW YORK 13, N.Y.

RussCo
PURPLE LAYOUT DOPE

for Tool . . . Die . . . Pattern or Template Layout and Check Lines on Castings. All lines show up Clear . . . Sharp . . . and well defined.

The best Layout Dope on the market { Gallons . . . . . $ 2.50 / Quarts 90

Buy from the originator. Order direct or from your local supply house.

RUSS SIMPSON COMPANY
1826 East Congress Street • Detroit 7, Michigan

New Patents of Tooling Interest

(for obtaining, see page 120)

MILLING MACHINE TRANSMISSION AND CONTROL MECHANISM, No. 2,338,121.
AUTOMATIC PRESSURE OPERATED LATHE, No. 2,338,125.
KNURLING DEVICE, No. 2,338,186.
LINEAR DIMENSION GAGE OR COMPARATOR, No. 2,338,190.
EXTRUSION MOLDING MACHINE, No. 2,338,203.
MECHANICAL ADJUSTMENT MEANS, No. 2,338,271.
PIERCING AND SHEARING TOOL, No. 2,338,289.
ADJUSTABLE CUTTERHEAD, No. 2,338,301.
METHOD OF ELECTROPOLISHING STEEL, No. 2,338,321.
APPARATUS FOR MAKING TUBULAR RIVETS, No. 2,338,330.

WANTED:

MANUFACTURER'S REPRESENTATIVE

New desirable territory open—to sell on commission basis—two outstanding punch press accessories; also, a very desirable repeat line of short-run punch press products. Give full details as to present connections and past experience. All correspondence kept confidential. Box DR-5.

TOOL & DIE JOURNAL
2460 Fairmount Blvd.
Cleveland 6, Ohio

DIAMONDS for Victory

• Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.)

The Most Complete and Up-to-the-Minute Line of Diamond Tools for War Production.

Distributed thru Mill Supply Jobbers

Send for Free Catalog and Grinders Instruction Card

DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, Pres.
935 E. 41st Street CHICAGO, ILL.

(CONTINUED FROM PAGE 202)

turret is held on center by the turret lock bolt which has hardened and ground flat taper faces on both sides. As wear occurs the bolt moves forward freely and seats solidly like a wedge, without lifting the turret. It is not necessary to provide a clamp to hold the ram when the tools are feeding into the work. However, the ram can be clamped against backward movement when a center is placed in a turret hole and the lathe is used for turning, instead of exchanging the turret for the tailstock.

The turret will take No. 2 tools projecting 9½"; the total length of ram travel with power or hand feed is 6¼".

Complete specifications are available from R. K. LeBlond Machine Tool Co., Dept. TD, Cincinnati 8, Ohio. 359.5-K

Carbide Tools Free Three Machines, Speed Up Production Rates

By changing to Carboloy cemented carbide-tipped cutters for a "rough" milling operation, a United States Naval Ordnance shop eliminated the use of two grinders and one milling machine and at the same time speeded up cutting time. The operation involved the milling of two sides of a breech casing made from SAE 4320 steel.

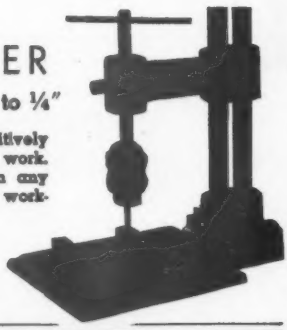
In retooling the machines, 10-bladed milling cutters of 5" diameters were tipped with Carboloy steel cutting grade 78 cemented carbide. Optimum machining conditions were obtained at 650

(TO PAGE 206—PLEASE)

BERGER

SENSITIVE HAND TAPPER

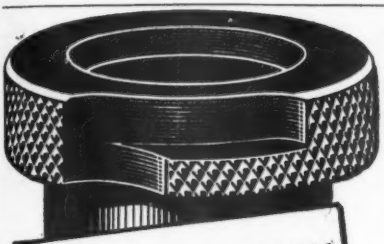
for hand tapping of delicate threads, from #0 up to ¼"



This handy device is precision-built and jig-bored and will positively eliminate expensive tap breakage or spoiled holes on costly work. The lapped spindle and guide assures perfect alignment in any position of the tap. The tapper comes complete with two work-holding jaws and special tap chuck.

TOOL SPECIALTIES CO.

RAYMOND-COMMERCE BLDG. NEWARK 2, N. J.



QUICK DELIVERY

Write for Specification Sheets and Prices . . .

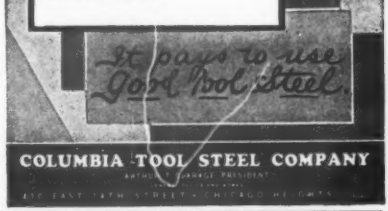
COLONIAL BUSHINGS, Inc.
145 Jos. Campau St., Detroit

COLONIAL DRILL JIG BUSHINGS

Columbia TOOL STEEL

MANPOWER—

You can conserve manpower by using tool steel that gives trouble-free, long run and high speed production.



COLUMBIA TOOL STEEL COMPANY

Quit Shoving Things Around . . . . Carry Them On

PORTELVATOR (Portable Elevating Table)

Save time . . labor . . costs with this "handy Andy" in your plant. Carry, lift, use for supporting table, for overhanging work, as table.

THE HAMILTON TOOL CO.
Ninth and Hanover Streets,
HAMILTON OHIO

Capacity to 20 tons

ARMSTRONG
TOOL HOLDERS and TOOLS

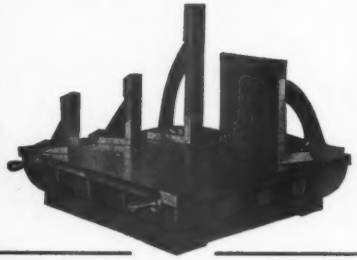
STANDARD WHEREVER METAL IS MACHINED

Over 96% of the machine shops and tool rooms use ARMSTRONG TOOL HOLDERS, because each is a permanent, multi-purpose tool that does the work of a complete set of forged tools. Each is a stronger, more efficient tool that takes cutter bits quickly ground from stock shapes of high speed steel, thus "Saves: All Forging, 70% Grinding and 90% High Speed Steel."
With the Correct ARMSTRONG TOOL HOLDERS for each operation you will be permanently tooled-up for every operation on lathes, planers, slotters and shapers. They are sold by all leading industrial distributors.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
340 N. Francisco Ave. Chicago 12, U.S.A.
Eastern Sales Office: 100 Lafayette St., N. Y.

MILWAUKEE
Surface Plates



A full line of surface plates, angles and box parallels. Standard plate sizes from 8"x 8" to 48"x 96", larger sizes with or without legs. Plates are finish-planed and scraped to insure a very accurate surface.

Write for details

J. C. BUSCH CO.
Engineers & Machinists Since 1907
172 SO. FERRY ST., MILWAUKEE, WIS.

(CONTINUED FROM PAGE 204)

sfpm with a table travel of 7½ ipm. The cut taken is 9" long and .125" deep. With this setup machining time was only two minutes for each side. The average life per grind with the carbide cutters was 40 pieces, as compared to 25 pieces per grind for high speed roughing cutters previously used. 82-K

Lens Cleaner Dispenser

A lens-cleaning cabinet dispenser, designed to meet the requests of industrial safety engineers for a handy, convenient unit has been placed on the market by the Wilkins Company, Cortland, N. Y. The cabinet contains a sprayer and bottle of K-LENS-M, a new lens cleaner, a supply of special lint-free cleansing tissue, and space for the disposal of used tissue. The sprayer extends from the top of the compact,

wooden cabinet and is located in a corner for greater convenience.

The lens cleaner removes smudges of oil and grease, leaving no film to catch dust and lint. It is particularly useful on safety goggles which are exposed to fine dust particles. The cleansing tissue is specially designed to leave no lint.

Dispenser cabinets placed at strategic spots in shops or plants encourage employees to clean goggles and eyeglasses more frequently and regularly reducing accident risks and poor workmanship. Eye fatigue is also reduced by glasses kept habitually clean thus building up personal efficiency of the workers.

A descriptive folder and price list is available from Wilkins Co., Dept. TJ, Cortland, N. Y. 992-K

SCHMIDT SOLDERING and OPEN FLAME TORCHES

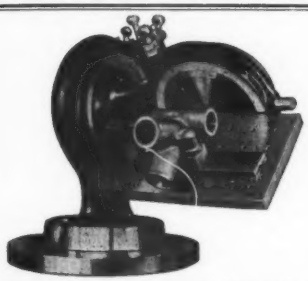
Use artificial or natural gas or gasoline. Start without generating—"soldering heat in less than a minute." Schmidt "CONCEALED FLAME" Soldering Torches hold coppers steadily at any desired heat for continuous work. Very economical.

A moderate investment in Schmidt Equipment will step up production, reduce costs and increase profits. Send for circular.

for all Soldering
Open Flame
Work
Brazing
Branding
Laboratory
Use
etc.

OPEN FLAME TORCH

MINN-KOTA Foundry & Mfg. Co., Dept. 805, Fargo, North Dakota



Computes Angles QUICKLY

The Studler Angle Computer so simplifies layout of die work, survey of castings, and inspection of precision-machined parts that users report it is doing the work in one-half to one-tenth of the time required by the sine bar method. Only one set-up is required. The work shown above was accurately surveyed in 15 minutes. Write today for Bulletin No. 2.

THE ANGLE COMPUTER COMPANY
5720 Melrose Avenue, Los Angeles 38, Calif.

STUDLER
ANGLE COMPUTER

HY-TEN

AISI NE SAE

Alloy Steels For Victory

Scientifically selected to conserve critical alloys and meet the requirements of the AIRCRAFT, ORDNANCE, and MACHINE TOOL industries.

Complete "EARMARKED" stocks of Aircraft alloy steels at Buffalo and Detroit.

WHEELOCK, LOVEJOY & CO., INC.
138 Sidney Street
CAMBRIDGE 39, MASS.
Cleveland 14, Chicago 23, Newark 5, Detroit 3, Buffalo 10, Cincinnati 32

ABC

HEADLESS PRESS FIT
HEAD PRESS FIT
FIXED RENEWABLE
SLIP RENEWABLE
HEADLESS LINERS

A. S. A. STANDARD
DRILL JIG
BUSHINGS

ALSO SCREWS • CLAMPS • LOCATING JIGS

Send for New Catalog No. 243

ACCURATE BUSHING COMPANY
447 NORTH AVENUE -:- GARWOOD, NEW JERSEY

"ROCKWELL"
HARDNESS TESTER
Immediate Shipment

The New "J" Model

383 Concord Ave.
New York 54, N. Y.
WILSON
MECHANICAL INSTRUMENT CO., INC

MILLING - DRILLING - BORING
ATTACHMENT for Heavy Duty Operations

PROMPT DELIVERY

EASY MOUNTING
Large Quill
4" Travel
(counter balanced, hardened and ground)
6 SPEEDS
250-3000 RPM
Lever and Worm Feeds
½ H. P. Motor

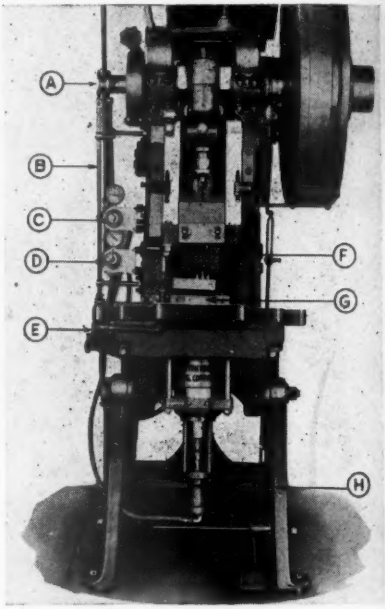
Specially engineered by RUSNOK to meet the demand for heavier duty and mill operations. Uses many types of cutters on a wide range of work. Large size spindle (No. 9 B & S taper). Takes ⅛" to ¾" end mills. Precision Engineered and Ruggedly Constructed Throughout.

Write for descriptive folder.

RUSNOK TOOL WORKS
4840 North Avenue, Chicago, Ill.

Dayton Rogers Cushion Blanking Dies

A new pneumatically controlled technique for producing flat die cut stampings at low cost is announced by the Dayton Rogers Manufacturing Co., Minneapolis, Minn. Designed primarily to meet the requirements of manufacturers for short run die cut parts where it is desired to limit the cost of the dies and punches, this method permits blanking



tools to be made at from 10% to 25% of the cost of the conventional type permanent blanking die.

By the use of a special sub-bolster, "G", blanking punches from ⅜" to ⅝" in thickness can be fastened thereon. Special hardened and ground stripping pins nested around the blanking punch pass thru the universal sub-bolster plate. The stripping action is controlled by the standard pneumatic die cushion fastened to the press bed frame. The blanking die is supported by the stripping pin, which

(TO PAGE 210—PLEASE)

Grobet SWISS FILES

5000 SHAPES and SIZES TO CHOOSE FROM

Genuine Grobet Precision Swiss Files are world famous for utmost precision and durability since 1812. Learn more about these chrome steel files—send for Catalog YF, the most complete of its kind.

GROBET FILE CO. OF AMERICA
421 Canal St. New York 13, N. Y.

A.C.E. *Special* CUTTING TOOLS HELP YOU MAKE *Production Quotas*

Speed Your Cutting With A. C. E. Accurately Machined Special Cutting Tools

The superior workmanship and greater accuracy of A.C.E. special cutting tools insure faster cutting and longer useful life.

Note—we make only specials, no tools for stock.

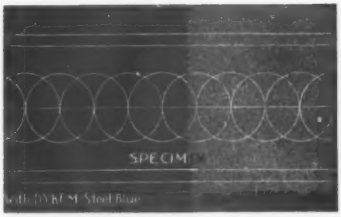
Send urgent inquiries for quick estimates. Bulletin on request.

AMERICAN CUTTER AND ENGINEERING CORP.
31753 Mound Road, Warren, Michigan

AMERICAN CUTTER

AND ENGINEERING CORP., WARREN, MICH.

SPECIALIZING IN HIGH SPEED CUTTING TOOLS TO YOUR PRINTS



DYKEM STEEL BLUE *STOPS LOSSES* making dies & templates

Simply brush on, ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information.

THE DYKEM COMPANY
2201 N. 11th STREET ST. LOUIS, MO.

A REAL HELPING HAND

It's a help that die makers, tool makers, machinery builders and general machinists have long sought—a more accurate and surprisingly faster way of transferring blind screw holes.

The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in ¼" to 1" diameters.

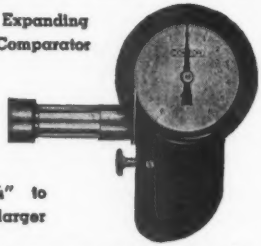
Send for price list.

HEIMANN MFG. CO.
Dept. T
Urbana, Ohio

2-point gaging of precision bores to fractions of .0001"

COMTORPLUG

Patented Expanding Internal Comparator

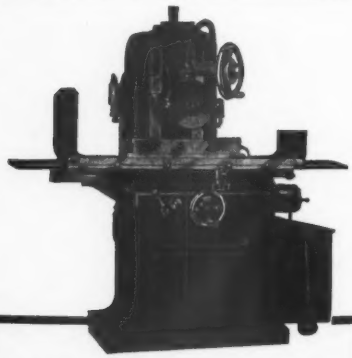


Sizes: ¼" to 7" and larger

Comtorplug puts into the hands of your operators, inspectors, trainees, a practical means of gaging holes to fractions of .0001". Accurately indicates size, out-of-round, front or back tapers, etc. Completely dependable, even in comparatively inexperienced hands.

REQUEST BULLETIN 39

THE COMTOR CO.
82 Rumford Ave. Waltham, Mass.



Grand Rapids Surface Grinders are the result of over thirty years actual experience in the building of precision grinding equipment . . . A patented vertical head adjustment is featured. When using the circular Vernier reading for extreme accuracy, the graduated circular plate can be set at zero in relation to the pointer extending inward from the rim of the large hand wheel. The pointer will travel in the same direction as the small inner hand wheel, but at ⅛th the speed . . . Attractive and amply illustrated Bulletin GL-100 is available.

GALLMEYER & LIVINGSTON CO.
304 Straight Ave., SW Grand Rapids, Mich.

(CONTINUED FROM PAGE 208)

is made of stock ⅜" to ⅝" thick and is backed up by the special hardened and ground pressure punch pad "F".

Two cams fastened to the punch press crank "A" control the two valve rods "B" and "C", which open and close two air valves "E". The combination pressure gage and regulator allows the operator to increase or decrease the air pressure required on the pneumatic die cushion, including the smaller air cylinder "H". This latter operates an ejector to remove the pieces from the die after blanking.

The blanking tools, used with inexpensive blanking dies in this manner, have a die life of 10,000 to 25,000 blanks. All piercing operations are done on a secondary setup and are independent of the blanking operation. This gives simpler operation and flexibility in tooling for new setups or when design changes are required. For example, additional holes may be added or the size or location of the holes may be changed. Die cut blanks .005" to .125", up to a blanking pressure of 100 tons, can be produced satisfactorily on the press equipment as shown. All control mechanism on the tooling is pneumatically controlled.

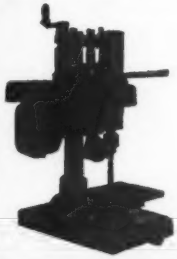
For complete information on the Cushion Blanking Dies or the small lot metal stamping service offered by this company, address Dayton-Rogers Mfg. Co., 2844 12th Ave., S., Minneapolis 7, Minn. 619.5-K

Thomas Redesigns Bending Rolls

A completely redesigned line of bending rolls, both vertical and horizontal types, has been announced by Thomas Machine Manufacturing Company, Pittsburgh, Pa. The new machines, built of electrically welded rolled steel plate, are capable of rolling angles, tees, flats, rounds, squares, pipe, beams, channels and special shapes of almost limitless variety. Arcs, spirals or circles can be formed on the new machines.

Planned on the basis of exhaustive data acquired in years of building the earlier line of Thomas bending rolls, the new machines are all steel construction, with cast steel bearing housings welded

(TO PAGE 212—PLEASE)



When Precision Work Calls for Tiny Holes
.004 to 5/16" diameter

The HAMILTON MUEHLMATT Super Sensitive DRILLING MACHINE

Instrument boards, Aircraft, Diesel, and other innumerable jobs often call for tiny hole drilling. Use this H-M and save on small drills still so hard to get.

THE HAMILTON TOOL CO.
Ninth and Hanover Streets
HAMILTON OHIO

M·B MODEL UTR 60,000 RPM

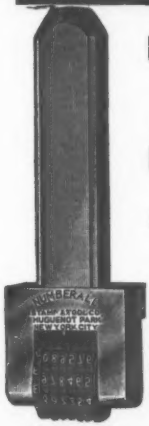
"UTILITY" Pneumatic GRINDER

A powerful, fast-cutting tool, streamlined in design, easy to handle. Designed for real production work and the toughest jobs. Precision made, excellent balance. Special grease-sealed bearings . . . no lubrication required. Fitted with steel housing, a special safety feature.

WRITE FOR CIRCULAR

M·B PRODUCTS
130-134 E. LARNED ST.
Detroit 26, Michigan, U.S.A.

NUMBERALL



NUMBERING MACHINES FOR STAMPING INTO METAL, ETC.

STAMP NUMBERS, etc. Quickly—Neatly PERFECTLY ALIGNED

Can be furnished with Shank for Press and with any number of wheels from 3 to 20.

Model No. 70

NUMBERALL STAMP & TOOL CO.
Huguenot Park Staten Island, N. Y.

Periodic Piece Inspection
IS FAST-EASY-ACCURATE

With
DAYTON ROGERS
LAYOUT FLUID

Just brush on deep Die Blue. Dries at once. Your chalk lines show clearly, no glare. Also used for original die, tool and pattern layouts. Sample on request.

HANDY 4 oz. Brush-in-can . . .40
PINT 80
QUART 90
GALLON. $2.80

DAYTON ROGERS MANUFACTURING CO.
2644 12th Ave. S., Minneapolis 7, Minn.

THE WONDER CUTTER

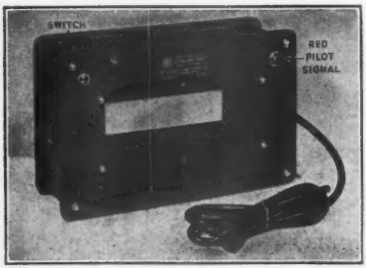
● Small enough to go in any out-of-the-way place—yet it cuts wire and rods up to ⅝ in. round (⅝-in. square) and band iron up to ¼-in. by 2-in.

Adjustable stop for gauging the length of pieces. Hardened cutters that last indefinitely.
Get the "dope" on the lowest priced cutter out—

THE WONDER
The Federal Foundry Supply Co.
4608 East 71st St. Cleveland, Ohio

AMC DEMAGNETIZER

A Tool Room Necessity



Every tool room needs this simple, portable, sturdy demagnetizer. Small parts passed through the powerful AMC field are instantly demagnetized. Large, flat surfaces can be demagnetized by sliding the device over the surface.

Available for either 115 V. or 220 V.

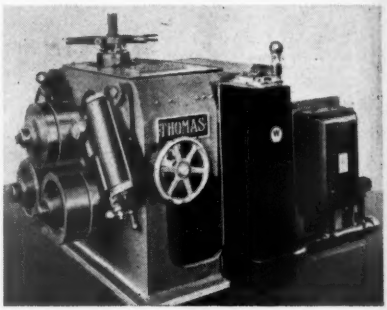
Write for full information.

ALOFS MFG. CO.
1619 Madison Ave., S. E., Grand Rapids, Mich.

(CONTINUED FROM PAGE 210)

into place. Bearings are bronze bushed and lubricated with high pressure fittings. The three vertical type benders have horizontal shafts and bend material in a vertical plane. The motor and gear reduction unit—enclosed with anti-friction bearings—is mounted on an extension of the main frame, making the unit entirely self-contained above the floor.

The horizontal type bending rolls have the rolls on vertical shafts and roll the material on a horizontal plane. The machines are driven thru a fully enclosed speed reducer, all shafts being mounted in anti-friction bearings, located in a pit



below the floor. This provides free access all around the machine and also reduces floor space.

A feature is an adjustable auxiliary roller, which counteracts twisting and keeps the leg of the angle square when rolled leg in. When angles are rolled leg out, the auxiliary roller serves as a gage to indicate when the proper diameter is rolled. It can be used also for enlarging circles which have been rolled too small.

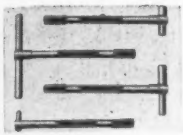
The work rollers are quickly adjustable in the width of slot by means of a stud and lock unit. The rolls, fully hardened on wearing surfaces, are placed on the closest possible centers, reducing to a minimum the length of the straight ends on finished circles. All three roll shafts, forged of high carbon steel, are power driven, enabling small diameters to be rolled with a single pass thru the machine.

For your copy of Bulletin No. 314 address Thomas Machine Mfg. Co., Dept. TD, Pittsburgh, Pa. 994-K

BRAND GUARANTEED PRECISION TOOLS

BRAND TELESCOPE GAGES

are precision ground—all parts subject to wear are hardened—ground to proper radius.

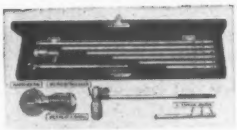


Made in 4 sizes:

- ⅞" to ½"
- ½" to ⅝"
- ⅝" to 1¼"
- 1¼" to 2½"

INTERNATIONAL INSIDE MICROMETERS

Highest accuracy—finest workmanship. Ask any man who owns one.



Made in 2 sets:

- 1½" to 6"
- 1½" to 12"

Also M & L Precision Tapper—Sine Plates and Bars—Universal Angle Plates

BRAND TOOL & SUPPLY CO. • FLOWER AT WASHINGTON LOS ANGELES 15, CALIFORNIA

AMAZING! DIAMOND BORING MACHINE RESULTS

From Your Lathe for $10.00

The Shearcutter Boring Tool is a new invention that cuts metal with a true knife-like action for the first time in history.

Check the Features

- It bores absolutely accurate holes.
- Usually eliminates necessity of reaming, grinding, diamond boring or honing.
- The bit may be rotated to present 10 to 20 new cutting edges before regrinding is necessary.
- Saves time, money, material and increases production.

ABOVE: the conventional type cutting tool is illustrated tearing the metal. BELOW: the slicing, knife-like action of Shearcutter Boring Tool.

Patents applied for. Infringers prosecuted.

SEND YOUR ORDER TODAY!

SHEARCUT TOOL CO.

361 S. MAPLE DRIVE, BEVERLY HILLS, CALIFORNIA

GAGE HANDLES

PLUG AND TRI-LOCK

Handles will fit gages of standard size. Precision made for accuracy of fit and long life.

These steel handles are economically priced and can be had in any quantity.

Write for Further Details

GREAT LAKES METAL SPECIALTY & MFG. CO.

1448 West North Ave., Chicago 22, Illinois

Die & Tool Makers

DESIGNERS AND MANUFACTURERS OF DIES · TOOLS · GAUGES · JIGS AND SPECIAL MACHINERY

J. J. BARTH, President

GLENN A. BARTH, Gen'l Mgr. — JOHN A. BARTH, Chief Engineer

THOMAS A. BARTH, Sales Mgr. — ROBERT A. BARTH, Superintendent

BARTH STAMPING & MACHINE WORKS

BARTH STAMPING & MACHINE WORKS · THE BARTH MANUFACTURING CO.

DENISON AND WEST 24TH STREET CLEVELAND OHIO 1826 COLUMBUS ROAD

YOST DRILL PRESS VISE

This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes.

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	3½	12½
2D	6	5½	23

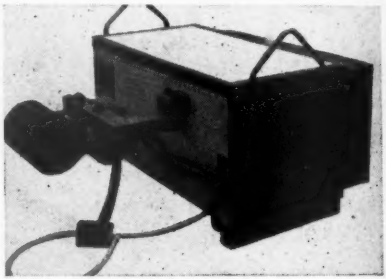
Do you need a vise of ANY type?

Write today for bulletins on the extensive Yost line

YOST MFG. COMPANY
1000 MAIN ST.
MEADVILLE, PENNSYLVANIA

Berwick Electric Metal Heater

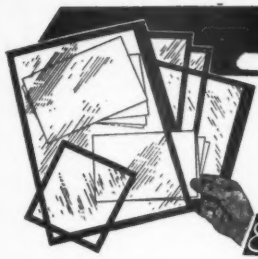
The Berwick Low Frequency Induction Heater, a 44-KVA transformer, with secondary voltage running from 2 to 10, designed for aircraft engine assembly, is a product of the American Car and Foundry Company, Dept. J, 30 Church St., New York City. One of the first applications was to heat a crankshaft for airplane engines—the crankshaft is 4½" in diameter and 10" long with tapering walls that are approximately ⅜" thick.



The crankshaft is heated to 400° F with extreme rapidity. Frozen bushings are slipped in and when the crankshaft and bushings reach shop temperature by slow air cooling the bushings are firmly shrunk into position.

Four other Berwick Induction Heaters are installed at an aircraft factory to heat crankshafts vertically instead of horizontally. The crankshaft is placed on a sliding carriage, moved in to be heated, and then withdrawn. The operation is controlled by a timing mechanism. The cooling water is automatically turned on before the current flows, and when the current is cut off it also cuts off the flow of water to protect the coil.

A smaller model, the Berwick Electric Induction 8 to 10 KVA Transformer is in use for heating such parts as a ring bearing, bull gear or face parts of gears. Such parts are employed as a secondary to the transformer and quickly rise in temperature so that they can be shrunk on a shaft or other unit part. 137-K



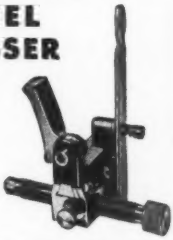
Save Time!

PROTECT prints and shop orders from grease and dirt.

Time wasted is money wasted. **Transparent Envelopes** save time. They keep costly charts, orders and tickets clean and readable throughout the job. They eliminate extra prints, etc. They're durable, non-inflammable and soon pay for themselves in time saved. Write for a sample and information.

Transparent SHADE CO 1161 SO. BROADWAY LOS ANGELES 15, CALIF.

Jiffy WHEEL DRESSER



A 5 MINUTE JOB IN 5 SECONDS

"Just a twist of the wrist"

Easily attached to standard surface grinder. Becomes part of machine. Absolutely true dressing regardless of relative position of wheel to work table, without disturbing set-up. All hardened, ground and lapped, except bracket.

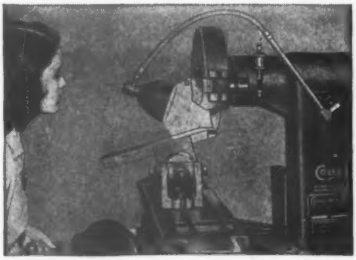
Write for Bulletin 602J.

◆

Made by **FLORIAN MFG. CO., Plantsville, Conn.**

ORDER THROUGH
AMERICAN STANDARD CO.
SOUTHINGTON, CONNECTICUT

VIMCOLIGHT



Reaches Those "Hard-to-Light" Spots!

Despite general improvements in over-all plant lighting, many machine tool operations can be speeded up . . . errors reduced . . . operators' eyes spared needless fatigue . . . by the use of even-glowing, non-glare VIMCOLIGHTS. It's the light that "gets around the corners." Adjustable; inexpensive. It cancels out the shadow menace. Write for circular. Vimco Manufacturing Co., 117 Chenango St., Buffalo 13, New York.

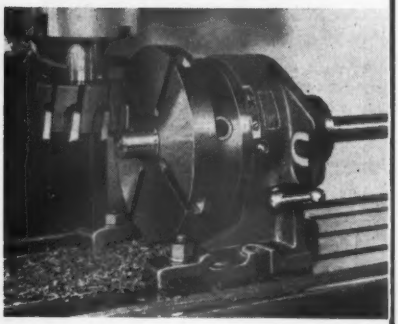
DUPLEX M-6
BAND AND DISC GRINDER

The latest in pedestal type grinders. Actually two machines in one! 14" disc for all rough work . . . 6 x 48" band for finishing. Precision-built to meet wartime production standards — quickly, economically!

Other styles and sizes in New Booklet on Finishing—Write Today

WALLS SALES CORP.
97 Warren Street **New York 7, N. Y.**

THE HARTFORD SPECIAL MACHINERY CO.
288 HOMESTEAD AVE. · HARTFORD CONN.

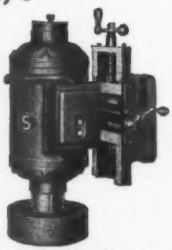


The Hartford Super-Spacer has a reputation for adaptability in tool rooms. When mounted (as shown milling bar stock) with a face plate and draw-in collet, a great variety of indexing jobs can be easily done.

Job Application Bulletin sent on request.

"RIGHT! YOUR MACHINE TOOL CAN NOW SERVE YOU AS A (STANDARD) GRINDER TOO."

YES SIR! You can now make your machine a "double purpose" machine, the "Standard Way". STANDARD VERTICAL SPINDLE GRINDERS can be easily mounted on your Planers, Boring Mills, Shapers, Milling Machines, etc., giving you added profits! Available with or without feeds, as preferred.

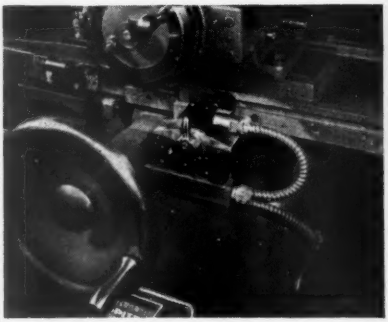


Write for Your copy of Catalog 43, today.

The STANDARD ELECTRICAL TOOL Co.
CINCINNATI · 4 · OHIO
Mt. Hope & Sixth St.

Internal Grinder Uses Electro-Hydraulic Control

The "Sav-Way Spitfire," said to be the first internal grinder to utilize the combination of hydraulic operation and electric control, is announced by Sav-Way Industries, Detroit, Mich. The name was given the new grinder because of its unusual speed—the extremely rapid table feed and reverse combine to give the machine exceptional speed on short work. Solenoid operated valves and aircraft



type micro-limit switches provide constant control and reduce time lag to a negligible minimum. Other outstanding features include short table stroke—$\frac{1}{32}$" minimum—flexibility, ease and convenience of operation, particularly for women operators, and facilities for quick, easy loading and unloading.

In addition to electro-hydraulic control, the Spitfire is equipped for hand table feed, a valuable time saver when setting up. It is available with either manual or electrically controlled power cross-feed. The standard machine is equipped with a manual operated wheel-truing mechanism with cam return; however a semi-automatic diamond wheel dresser, electrically operated with automatic, adjustable, slow-down of table traverse while dressing the wheel, is available. This automatic dresser is protected to prevent damage to the machine through mis-operation.

The Spitfire Grinder is equipped with the Sav-Way Gold Seal Spindle, well known as "the spindle that breathes"

(TO PAGE 218—PLEASE)

EVEREDE SPECIAL BORING BARS ★

MADE TO SPECIFICATIONS
with EVEREDE Triangle Bit

READY FOR CUTTING

NO FORMING OR GRINDING NECESSARY.

Micrometer adjustment with indicator dial on wrench. Assuring accuracy regardless of bit angle. Furnished with solid bits of Tungsten carbide, "Stellite" or High Speed Steel.

Write for Folder.

EVEREDE TOOL CO. WILLIS STUTSON
180 N. Wacker Drive, Chicago 6

Gusher COOLANT PUMPS

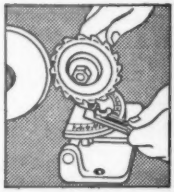
Sizes from 1/10 to 2 h. p.
Pumping capacity up to 200 g.p.m. Many patented and exclusive features.

Write for descriptive literature

The Ruthman Machinery Co.
1808 Reading Rd., Cincinnati, Ohio

NEW TOOL GRINDER

Grinds Milling Wheels . . . Slitting Saws . . . Lathe Tools . . . Wood Turning Chisels . . . Many Small Tools to any Degree or Angle.



Write for Literature

T. & H. MFG. CO.
811-L East 31st.
KANSAS CITY 3, MO.

HARDNESS TESTING

has been done with the
SCLEROSCOPE
since 1907

•

THE SHORE INSTRUMENT & MFG. CO., INC.
9025 Van Wyck Avenue
Jamaica, N. Y.

External Cylindrical and Centerless GRINDING

Quality in Quantity

J & R Specialties
Production Grinding
5507 Francis Ave., Cleveland, Ohio
Phone DI. 9180

FRONT LEVER BENCH PUNCH

STURDY • DURABLE • HANDY

Capacity 7/16" hole through 1/4" steel or 3/8" hole through 5/16" steel.
All Parts Interchangeable - - - - - - - - Weight 70 lbs.
Punches and dies carried in New York stock from 1/16" to 1/2" by 64ths. Also some drill numbered and commonly used square, flat and oval sizes.

CATALOG No. 8 ON REQUEST

T. H. LEWTHWAITE MACHINE CO.
314 East 47th Street -:- New York 17, N. Y.

CONTRACT TOOLING AND PRODUCTION

Illinois

DRESEL-BETZ COMPANY
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings

★

PRESS BRAKE DIES
and Punching
Attachments for All
Makes of Press Brakes
DREIS & KRUMP MFG. CO.
7428 S. Loomis Blvd. Chicago 36, Ill.

★

ROCKFORD DIE & TOOL WORKS, INC.
1816 Seventeenth Avenue, Rockford, Illinois. Phone MAin 3084. Designers and Manufacturers Tools-Dies-Jigs-Fixtures. Production Job Work

Michigan

DAVIS TOOL & ENGINEERING CO.
19350 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery, Sheet Metal Stampings and Assemblies

ROYAL OAK TOOL & MACHINE CO.
621 E. Fourth St., Royal Oak, Mich., HUmhurst 6560. Manufacturers of Tools, Dies, Jigs, Fixtures, Special Machinery and Designing. Hoeh Self-Centering Cylinder Reamers.

New Jersey

BERGEN MACHINE & TOOL COMPANY, INC.
189 Franklin Ave., Nutley 10, N. J. Facilities on over 200 Machine Tools including automatics and centerless grinders, open for contract work. Small and large production runs.

THE VIKING TOOL & MACHINE CORP.
6 Main Street, Belleville, New Jersey. Tools-Dies-Jigs-Fixtures-Molds-Gages-Machines-Stampings-Specialties

★

PRECISION FORM GRINDING
Specialists in grinding Circular and Flat FORM-TOOLS, FORM Counterbores, FORM Flat-Drills, and related types of FORM grinding. Also step-grinding of Tungsten and Molybdenum Rods.
Send Prints for Quotation and Delivery
J. & S. Tool Co., 477 Main St., E. Orange, N. J.
(Makers of J. & S. Radii & Angle Dressing Tools)

★

New York

CONRAD & MOSER
2-36 Borden Ave., Long Island City, N. Y. Machine Tools & Molds, Parts & Machines, Aluminum Cast Parts, Aluminum Sheet Formed Housings

RANE TOOL CO., INC.
17 Ross St., Jamestown, N. Y., Phone 5834. Specialists in Blanking, Forming, and Drawing Dies

Ohio

★

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, MUlberry 2600
DESIGNERS AND BUILDERS
Jigs & Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

THE DENNING MANUFACTURING CO.
1775-81 E. 87th St., Cleveland, O., CEdar 6691. Designers and Builders of High Grade Dies

GENERAL DIE & TOOL CO.
2067 W. 58th St., Cleveland, O., WOodbine 4736. Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery. Manufacturing

THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, O. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio, WOodbine 2440-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring

THE LORAIN MACHINE & TOOL CO.
1951 West 90th St., Cleveland, O., MEIrose 5818. Designers and Builders of Dies, Jigs, Fixtures, Gages, Special Machinery, Jig Boring

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, Bedford 1204. Tool Makers—Specialists in Aircraft Work

PARAMOUNT TOOL CO.
1392-98 East 43rd St., Cleveland, O., HEdicott 2220. Jigs, Fixtures, Dies, Experimental Work

THE PHOENIX MACHINE CO.
2711 Church Ave., Cleveland, O., CHerry 1048. Contract Grinding, Boring and Planing. Lester-Phoenix Die Casting and Plastic Molding Machines

A. P. SCHRANER & CO.
3838 Payne Ave., Cleveland, O., HEndersen 8644. External Cylindrical Lapping Machines, Special Machinery, Tools, Dies, Jigs, Fixtures

THE VARIETY MACHINE & STAMPING CO.
12906 Elmwood Ave., Cleveland, O., LAkewood 0420. Designers and Manufacturers of Dies, Metal Stampings. 250 tons capacity

---

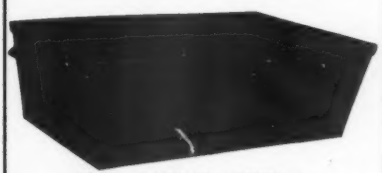
(CONTINUED FROM PAGE 216)

because of its unique self-ventilating feature, which provides for a constant flow of oil-air mist through the working parts of the spindle and keeps the spindle free from dirt and coolant.

Like all Sav-Way grinders, the Spitfire is neoprene insulated. Neoprene pads between the bed and base absorb vibration and prevent distortion. The modern functional design of the grinder gives it a characteristic clean cut simplicity. The sloping control panel with its grouping of all controls is arranged for easy operation. The manufacturer has developed a number of ingenious fixtures designed to make loading and unloading quick and accurate.

Complete data on the new Spitfire Internal Grinder is available from Sav-Way Industries, Box 117, Harper Station, Detroit 13, Mich. 16-K

New Nesting Type Tote Pans



20" long x 12" wide x 6½" deep.
16 ga., drag holes and handles both ends.

J. L. LUCAS & SON, INC.
Bridgeport, Conn.

West's Positive Automatic Stop For Dies

SAVES MACHINE TIME & MATERIAL

IMMEDIATE DELIVERY

Simple In Operation-Positive In Action-Easy to Install
Instructions for mounting included with Stop . . . . . Price $2.00

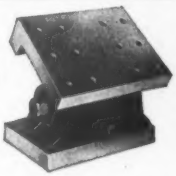
R. C. WEST
Wilbur & Hazeltine Aves. • Kenmore, N. Y.

AXELSON CAN SOLVE YOUR GAGE PROBLEMS

Today's complicated manufacturing operations demand a wide variety of accurate working and inspection gages. Axelson can produce gaging equipment of any type—thread gages, plug gages, special angle gages—gaging fixtures, jigs—hobbs, reamers, taps, and milling cutters. Fifty years of manufacturing have given Axelson the broad experience needed for fine gage making. Submit your gage problems to Axelson today!

AXELSON MANUFACTURING CO.
6160 S. BOYLE AVENUE (BOX 98, VERNON STATION) LOS ANGELES 11, CALIF.
50 Church St., New York 7; 3844 Walsh St., St. Louis 16; 204 Munsey Bldg., Washington 4, D. C.

McMahon Adjustable Angle Plates



Model "A" Adjustable Angle Plate with four ⅜" "T" Slots. Size, 3" x3"x3¾". *Price*, $14.40. Shipping weight, 5 lbs.

Model "D" Adjustable Angle Plate with 16, ⅜"x16 threads tapped holes. Size, 6" x 6" x 7½". *Price*, $42.00. - - - - Shipping weight, 45 lbs.

FRANK McMAHON CO. 142 S. June Street Dayton 3, Ohio

ARTUS ARBOR SPACERS

The COLOR tells the THICKNESS

ARTUS Arbor Spacers made of plastic in various colors identify thickness at a glance! .001, .0015, .002, .003, .005, .0075, .010-.030. Speed up accurate fitting at low cost. Write for folder.

Spacers, Gaskets, Shims

IMMEDIATE DELIVERY

INDUSTRIAL PRODUCTS SUPPLIERS
2 Broadway Dept. T New York, N. Y.

NEW CALIPER
SPEEDS UP DEFENSE WORK

Direct Reading Accurate, Fast, Simple. New timesly tool SAVES TIME, SPEEDS UP PRODUCTION. Graduated scale, easily read at a glance. Adaptable to all types, shapes of work, wood or metal. Measures 0 to 4 inch.

FREE LITERATURE and PRICE on request

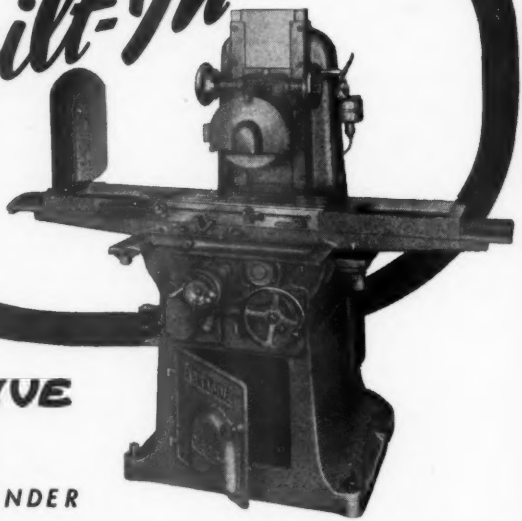
T & H MFG. CO.
811-L East 31st, K.C., Mo.

SEND US YOUR PRINTS FOR Quotations

THREAD GRINDING
BROACHING
MAGNETIC INSPECTION

TAYLOR MACHINE COMPANY
MANUFACTURERS OF
AVIATION & AUTOMOTIVE PARTS
Gear Specialists
1017 EAST 81st ST. • CLEVELAND 3, OHIO

ACCURACY & DEPENDABILITY
"Built-In"



ABRASIVE
3-B
SURFACE GRINDER

In excellence of design, workmanship, and materials of construction, the ABRASIVE 3-B is "tops" in surface grinders. To insure perfect alignment and freedom from distortion the bed of this machine is a massive one-piece casting weighing over 1500 lbs. Typical of ABRASIVE quality, the precision spindle of alloy steel, hardened, ground and lapped, is carried in a phosphor bronze box at front, adjustable for wear, and super-precision ball bearings at rear. For accuracy and dependability, specify ABRASIVE 3-B.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

SEND FOR
DESCRIPTIVE
BULLETINS

ABRASIVE MACHINE TOOL COMPANY - - EAST PROVIDENCE 14, R. I. - - Dealers in Principal Cities

SHELDON

In the MARINE TRADITION!

Machines and machine tools as well as men must measure up to MARINE CORPS standards before acceptance . . . must be capable of handling whatever situation arises. That is why we are proud that SHELDON LATHES were selected for the Marine Trailerized Machine Shops as well as for the Army's "Mobile Machine Shop and Mobilized Instrument Repair Shop Units," and as the maintenance lathes for many Navy craft.

Modern battle equipment requires precision machinery. Operation under battle conditions requires rugged, reliable and dependably accurate machine tools. In SHELDON Precision Lathes all of these requirements are fulfilled.

SHELDON MACHINE CO., INC.
4236 N. Knox Ave.
Chicago 41, U. S. A.

SAVE CHIPPED CARBIDE TOOLS

DI-MET DIAMOND WHEELS rapidly remove broken corners . . . keep tools sharp . . . increase cutter economy!

LONG-LIVED DI-MET diamond abrasive wheels are fast stock removers on sintered carbides — quickly grind away or cut-off broken carbide inserts to provide new cutting edges—enable hundreds of extra hours of production to be obtained from broken tools before discarding or retipping becomes necessary.

Immediate Delivery

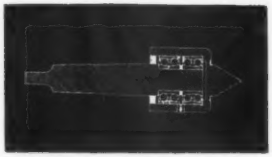
Write for **FREE** *catalog!*

Our new catalog illustrates all standard types of DI-MET resinoid bonded wheels, gives specifications, prices and discounts. Write for your free copy today!

FELKER MANUFACTURING CO.
1111 BORDER AVE., TORRANCE, CALIF.

MANUFACTURERS OF DIAMOND ABRASIVE WHEELS

PRECISION ALIGNMENT...



4

ROWS OF PRECISION BALL BEARINGS

QUADRO Precision LIVE CENTERS will outlast old-fashioned solid centers to pay for themselves quickly. They combine the rigidity of the solid lathe center with the frictionless properties of the ball-bearing to form a tool which will increase production without sacrificing accuracy. Manufactured in all tapers and sizes.

Write for Circular.

DAKON
TOOL AND MACHINE CO., INC.

QUADRO
Precision
LIVE CENTERS

TODAY... PRECISION

PARTS FOR WORLD BATTLEFRONTS

TOMORROW... PRECISION

★

PARTS FOR PEACETIME INDUSTRY THAT WILL ASSURE PRODUCT SUPERIORITY

★

C. M. SMILLIE & CO.

1108 WOODWARD HGTS., FERNDALE, MICH.

PRECISION ◆ YESTERDAY ◆ TODAY ◆ TOMORROW

ADVERTISERS INDEX

Abrasive Machine Tool Co. 220
Accurate Bushing Co. 207
Ace Abrasive Laboratories 201
Acme Industrial Company 152
Acme Tool Company 167
Acromark Co., The 170
Advance Foundry Co., The 132
Agat-Detroit Company 37
Ajax Steel & Forge Co. 185
Allegheny Ludlum Steel Corp. .. 2
Alofs Mfg. Co. 212
American Cutter & Engineering Corp. 209
American Gauge Co., The 145
American Industrial Publishers . 124
Ames Co., B. C. 177
Ampco Metal, Inc. 69
Angle Computor Co., The 207
Anker-Holth Mfg. Co. 155
Armstrong-Blum Mfg. Co. 228
Armstrong Bros. Tool Co. 206
Arnold Tool Co. 47
Autometric Corp. 163
Automotive Maintenance Machinery Co. 63
Axelson Manufacturing Co. 219

Baker Brothers, Inc. 189
Barnes Co., Inc., W. O. 168
Barth Stamping & Machine Works 213
Behr-Manning (Division of Norton Company) 54
Bellows Co., The 8
Bergen Machine & Tool Co., Inc. 218
Besly Co., Charles H. 35
Bissett Steel Co., The 162
Black Drill Company 50
Boyar-Schultz Corp. 171
Brand Tool & Supply Co. 213
Bunell Machine & Tool Co. ..76, 77
Burke Machine Tool Co. 186
Busch Company, J. C. 206

Cadillac Glass Co. 202
Carborundum Company, The 38
Catalin Corp. 98-N, 98-O
Challenge Machinery Co., The .. 136
Chamberburg Engineering Co. .. 130
Chicago Mfg. & Distributing Co. 49
Chicago Rawhide Mfg. Co. 187
Chicago Screw Co., The 42
Chicago Wheel & Mfg. Co. 71
Cincinnati Grinders, Inc. 24
Cincinnati Milling Machine Co., The 25
Cincinnati Shaper Co., The 41
Cleveland Tool Engineering Co. 62
Cleveland Twist Drill Co., The 84
Cleveland Universal Jig Company 218
Colonial Broach Company 51
Colonial Bushing Inc. 205
Columbia Tool Steel Co. 205
Comtor Company, The 210
Conrad & Moser 218
Cooley Electric Mfg. Corp. 65
Cooper-Bessemer Corp., The 109
Criterion Machine Works 177
Crobalt Inc. 134
Crucible Steel Co. of America .. 73
Cullen-Friestedt Co. 192
Cullman Wheel Company 182
Cunningham Co., M. E. 203

Dakon Tool & Machine Co., Inc. 223
Danly Machine Specialties, Inc. 27
Davis Tool & Engineering Co. 218
Dayton Rogers Mfg. Co. 211
Dearborn Gage Company 6, 7
Denning Mfg. Co. 218
DeSanno & Son, Inc., A. P. ... 45
Detroit Reamer & Tool Co. ... 226
Detroit Stamping Co. 138
DeVlieg Machine Co. 148
Diamond Tool Co. 204
Die Supply Company 197
DoAll Co., The 194
Douglas Machinery Co. 165
Dreis & Krump Mfg. Co. 218
Dresel-Betz Co. 218
Dumore Company, The 17
Dykem Company, The 209

Eastern Etching & Mfg. Co. ... 98B
Economy Engineering Co. 151
Edroy Products Company 179
Electrix Corporation 16
Enterprise Machine Parts Corp. 6
Erickson Steel Company 52, 53
Everede Tool Company 217
Ex-Cell-O Corp. 56

Federal Foundry Supply Company 212
Federal Products Corp. 29
Federal Tool Corp. 67
Felker Mfg. Co. 222
Finegan-Campbell Co. 143
Firth-Sterling Steel Co. 74
Florian Manufacturing Co. 215
Fonda Gage Company 126
Ford Mfg. Co., M. A. 66

Gairing Tool Co., The 72
Gallmeyer & Livingston Co. ... 210
Galter Mfg. Co. 178
General Die-Stamping-Tool Co. 56, 81
General Die & Tool Company .. 218
General Engineering & Mfg. Co. 181
Gibson Co., Wm. D. 195
Golconda Diamond Products Corp. 174
Gorton Machine Co., George 54
Gottscho, Adolph 208
Great Lakes Metal Specialty & Mfg. Co. 213
Grobet File Co. of America .28, 209

Haines Gauge Co. 193
Hamilton Tool Co., The 205, 211
Hammond Machinery Builders .. 197
Hardinge Brothers, Inc. 3
Hartford Special Machinery Co., The 216
Heimann Mfg. Co. 209
Heller Brothers Co. 13
Herman Stone Co., The 181
Hoggson & Pettis Mfg. Co., The 183
Holo-Krome Screw Corp., The .. 82
Hovis Screwlock Co. 113
Howell Clamp Co. 200
Hy-Pro Tool Co. 172

Ideal Tool & Die Co., Inc. 193
Illinois Tool Works 199
Industrial Machine Co. 218
Industrial Products Suppliers .. 219
Invincible Tool Co. 198

J & R Specialties Co. 217
J & S Tool Company 176, 201, 218

Kalamazoo Tank & Silo Co. ... 142
Kearney & Trecker Products Corp. 31
Kiffer Tool & Die Co. 218
Knu-Vise, Inc. 141
Kold-Hold Mfg. Co. 158

Lakeside Steel Improvement Co., The 191
Lapointe Machine Tool Co. 21
Latrobe Electric Steel Co. 123
Lavallee & Ide 119
Leach Machinery Co., H. 203
Lee Co., K. O. 164
Lempco Products, Inc. 11
Lewthwaite Machine Co., T. H. 217
Lima Electric Motor Co., The .. 39
Linderme Machine & Tool Co., Inc. 140
Linley Brothers Co. 144
Logan Engineering Company 20
Lorain Machine & Tool Co. 218
Lucas & Son, Inc., J. L. 219
Lufkin Rule Co., The 214

M-B Products 211
Magnetic Holding Devices 23
Majestic Tool & Mfg. Co. 191
Manufacturers Supply Co. 169
Marvel Tool & Machine Co. 153
Masonite Corp. 46
Master Gauge Co. 173
Mattison Machine Works 59
McKinney Tool & Mfg. Co. .. 18, 19
McMahon Co., Frank 219
Mead Specialties, Inc. 175, 185
Mercury Metal Die & Letter Co. 139
Meyers Company, W. F. 78
Michigan Chrome & Chemical Co. 196
Minn-Kota Mfg. Co. 207
Moore Special Tool Co. 64
Muehlhausen Spring Corp. 137

National Twist Drill & Tool Co. 5
New England Carbide Tool Co. . 80
Niagara Blower Co. 154
Nichols-Morris Corporation 121
Noble & Stanton, Inc. 218
Nobur Mfg. Co. 180
Norton Company 197
Numberall Stamp & Tool Co. ... 211

Oliver Instrument Company 190
O'Neil-Irwin Company 117

Paramount Tool Co. 218
Peerless Machine Co. 60
Perfex Gage & Tool Co. 44
Phoenix Machine Co. 218
Pipe Machinery Co., The 30
Procunier Safety Chuck Co. 183
Production Machine Co. 200
Producto Machine Co., The 199
Putnam Tool Co. 1

Rane Tool Company, Inc. 218
Reid Co., Wm. 196
Republic Gage Co. 160
Robbins Engineering Co. 133
Roberts Rubber Co., Weldon 175
Rockford Die & Tool Works, Inc. 218
Rockford Magnetic Products Co. . 195
Royal Oak Tool & Machine Co. . 218
Rusnok Tool Works 208
Ruthman Machinery Co. 217

Sanford Mfg. Co. 179
Sav-Way Industries 15
Schauer Machine Co. 156
Scherr Co., Inc., George 115
Schraner & Co., A. P. 215
Severance Tool Industries 32
Shearcut Tool Co. 213
Sheffield Corp., The 34
Sheldon Machine Co., Inc. 221
Shore Instrument & Mfg. Co., Inc., The 217
Slewek Tool Division of Domestic Industries, Inc. 22
Simpson Co., Russ 203
Skilsaw, Inc. 127
Smillie & Company, C. M. 224
Smit & Sons, Inc., J. K. 184
Smith Tool & Engineering Co. .. 146
Sommer & Adams Co., The 227
Sossner Tap and Tool Corp. 173
South Bend Lathe Works 40
Springfield Machine Tool Co. ... 68
Standard Electrical Tool Co. ... 216
Standard Pressed Steel Co. 189
Star Machine & Tool Co. 110
Sunnen Products Co. 48
Swedish Gage Co. of America .. 187

T & H Manufacturing Co. ..217, 219
Tannewitz Works, The 159
Taylor Machine Co., The 219
Thermo Electric Mfg. Co. 150
Timken Roller Bearing Co. 26
Tomkins-Johnson Co., The 33
Tool Specialties Co. 205
Tools & Gages, Inc. 129
Transparent Shade Co. 215
Turner Gauge Grinding Co. 10
Turner Machinery Co. 55

U. S. Tool & Mfg. Co. 31
United States Treasury 128
Universal Engineering Co. ..166, 188

Vard, Inc. 43
Variety Machine & Stamping Co. 218
Viking Tool & Machine Corp. .. 218
Vimco Manufacturing Co. 215
Vinco Corporation 79

Wales-Strippit Corp. 125
Walker-Turner Corp. 57
Walls Sales Corp. 215
Webber Gage Co. 70
Welch Industries, Inc. 75
Welding Equipment & Supply Co. 161
Wells Mfg. Corp. 14
West, B. C. 219
Wheelock, Lovejoy & Co., Inc. .. 207
Whistler & Sons, Inc., S. B. .. 147
Wilson, K. R. 12
Wilson Mechanical Instrument Co., Inc. 208
Wittek Mfg. Co. 135
Woodworth Company, N. A. 4

Yost Mfg. Co. 214

Lower DEEP DRILLING *Costs* WITH OIL-HOLE DRILLS!

Shorten the Time of Drilling Operations!

One sure way of reducing deep-drilling costs is to use a drill that enables you to perform the drilling operation faster.

This is the outstanding advantage of *this* Oil-Hole Drill which has two oil holes that follow the twist of the drill the entire length of the shank. With this advanced type of drill, oil is forced through the shank, the entire length of the drill, *direct to the cutting edge*, thus making it possible to speed up drilling operations tremendously without endangering the tool through overheating.

Reduce Drill Expense!

Another sure way of reducing deep-drilling costs is to use a drill that, because of its longer life, effects a saving in tool outlay.

Here also the Oil-Hole Drill has an advantage over ordinary drills. Because of its cooling feature, it has a life two to three times that of ordinary drills.

Cut Down Spoilage Losses! Use a Drill that Automatically Clears Away the Chips!

All sizes from 3/8" to 3 1/2" in diameter and up to 36" overall

●

Detroit Reamer & Tool Co.

2830 E. 7-Mile Road Detroit 12, Michigan

Manufacturers of

Oil-Hole Drills . . . Special Reamers . . .
Circularity Relieved Reamers and End Mills
Also Special Tools

PRODUCTION INCREASER No. 4

• This hydraulically operated machine has four milling cutters for milling relief forms in aircraft engine parts. Engineered to a particular job? Yes, but, like Sommer & Adams machines generally, capable of many variations in design and purpose to fit individual requirements—your requirements.

Special Delivery FROM SOMMER & ADAMS

The Sommer & Adams Co. places at your command a 25-year acquaintance with the intricacies of special design and construction.

THE SOMMER & ADAMS COMPANY
18511 EUCLID AVENUE • CLEVELAND, OHIO

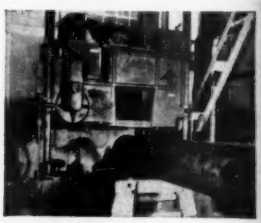
Custom-Built EQUIPMENT FOR MANY PURPOSES

The Hack Saw has grown up again! And now you can cut off large billets, forgings, die blocks, etc., up to 24 inch round or square, with the same degree of economy you cut off smaller size work. Yes, the new No. 24 MARVEL is actually a "hack saw," in spite of its mammoth size, since it employs a reciprocating blade. Of course, it uses a much larger hack saw blade than any heretofore available (36" long, 4½" wide, ⅛" thick); but it's still an "inexpensive hack saw blade" compared to the cost of large capacity circular cold saw blades. And, because this hack saw blade is comparatively inexpensive, users of the new giant No. 24 MARVEL machine will not hesitate or worry over cutting off the modern tough alloys in big sizes—a problem that has caused so many headaches where only circular cold saws were available for such large work.

The photos shown were taken at the Mesta Machine Co., Homestead, Pa.—one of the finest-equipped and most modern "heavy" machine shops in the world. The machine is shown cutting off a gigantic 24" round forging. Mesta now has three identical No. 24 MARVEL machines which are doing a fine cutting-off job on all sorts of large-size alloys, faster and cheaper, without "fuss," or the nerve-racking howling and groaning of their previous circular saw methods.

Write for Catalog showing complete line of MARVEL Saws

How big is this machine? Judge from the man in the photo. Its weight, 16,000 pounds—8 tons! Twice the weight of the No. 18 MARVEL heretofore the world's largest hack saw!



This giant saw bears no resemblance to any "small size" hack saw; it follows the modern, basic, exclusively "big saw" design of the No. 18 MARVEL.

ARMSTRONG-BLUM MFG. CO. 5700 Bloomingdale Ave., Chicago, U.S.A. Factories: Chicago, U.S.A. and Lancaster, Eng.